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FOOT CARE AND SHOE FITTING

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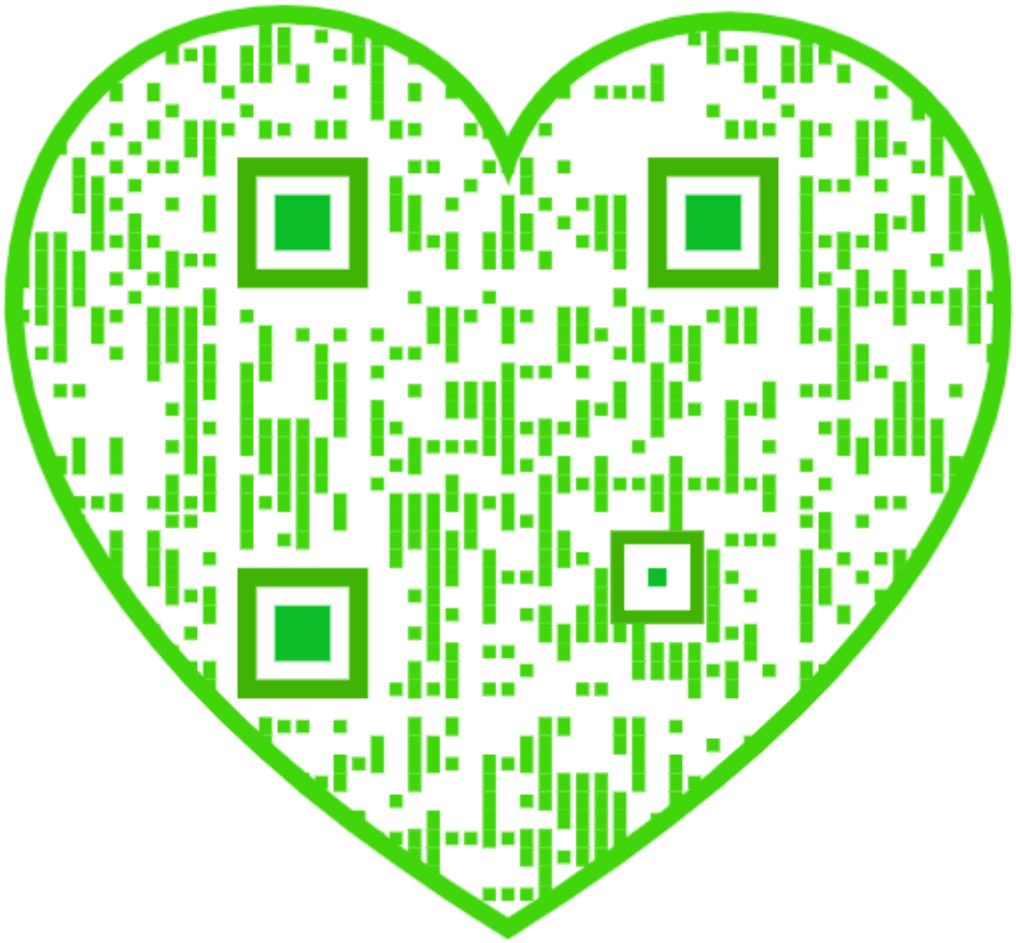

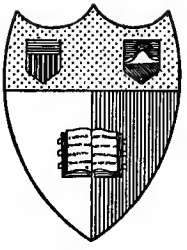

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A MANUAL

ON

FOOT CARE AND SHOE FITTING

MANN AND FOLSOM

U. S. Marine with full equipment. Complete weight of equipment 87–90 lbs.

A MANUAL

ON

FOOT CARE AND SHOE FITTING

FOR OFFICERS OF THE U. S. NAVY
AND U. S. MARINE CORPS

BY

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WITH 58 ILLUSTRATIONS

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We, as officers of military organizations, "are concerned to prevent the loss of even that one man in marching, and this can only be achieved by infinite pains and attention to a HOST OF *details, each* TRIVIAL IN ITSELF."—LELEAN.

PREFACE

An opportunity has been taken to present some of the results of our experience on this Post for the consideration of the line officer.

The numerous demands made upon the modern officer renders it difficult for him to devote the proper time to the important subject—*Care of the Feet of His Marching Command.*

It is hoped that the preparation of this little publication will serve as a guide, a source of reference, and at the same time serve to create an interest in this subject, causing the reader to realize the relative importance of the same. Should this result be accomplished, it will probably justify the expenditure of the energy involved.

There is little claim to originality, as the data have been compiled from a variety of sources.

INTRODUCTION

Mobility and motility of an organization has been and continues to be one of the prime requisites for military successes.

Notwithstanding the extensive motorization of modern armies, the results of the recent war tends to demonstrate that pedestrial motion still remains a vital factor in bringing the units into tactical and strategical positions.

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FOOT CARE AND SHOE FITTING

VALUE OF THE PROPER FOOT CARE

Mobility is the first requisite of the soldier and to insure this the infantry officer should devote as much attention to the care of the feet of the men of his unit as the cavalry officer devotes to the care of the feet of his horses. This, however, is not always the case.

The European authorities allow, when unseasoned troops take the field, for 10 per cent. of incapacitation through preventable foot injuries. This is almost equal to the casualties following an engagement with the enemy. More emphatically expressed; should a "million citizens spring to arms over night," there is every reason to expect 100,000 of them to be on the sick-list, because of foot disorders.

According to Napoleon's dictum, "more battles are won by strength of leg than by force of arms." The military successes of Stonewall Jackson have been attributed largely to the marching capacity of his command, which officer is quoted as saying that he had rather lose two men in battle than? one man in marching.

Another military leader believes that battles are won more by "sweat than slaughter." According to Wellington "the most essential part of a soldier's equipment is a good pair of

shoes, and—, another good pair of shoes." Another mili ary leader is quoted saying t at "getting there f rst with the most won battles."

In the Franco-Prussian War, over thirty thousand German soldiers were incapacitated in the first few weeks on account of preventable injuries to the feet.

"The army which marches best, other things being equal, is the successful army." (Munson.)

ORTHOPEDIC ORGANIZATION

(*a*) **Orthopedic Surgeon.**

It has been the custom of this Post to designate one of the medical officers as orthopedic surgeon; who, in addition to his other duties, is responsible for formulating the necessary rules and regulations on foot care and shoe fitting.

Two of the overseas regiments, leaving this Post, had a medical officer who had received some instruction on this subject, and acted in this capacity.

In any organization, unit, or detachment, it appears advisable to assign one medical officer to this duty, preferably one who is interested in this subject.

(*b*) **Foot Inspectors.**

From all reports, the foot inspectors have rendered very valuable assistance, during the recent war. These men were of two classes. One class was composed of Marines, who had enlisted for this class of duty, which duty they performed under the supervision of the medical department. Another class were men of the hospital corps who had previous instruction or training along this line.

There should be one inspector for each thousand men when they take the field. The orthopedic surgeon should be prepared to instruct and train such members of the hospital corps as may be deemed necessary for this work.

RESPONSIBILITY FOR PROPER FITTING OF SHOES

This appears to be a case of divided responsibility, according to Marine Corps Orders No. 185, (4) and 185, (5) (Series 1916), the responsibility rests largely with the company commander.

The situation is analogous to sanitation. The regulation requires the commanding officer to be responsible for the sanitary condition of his station, yet requires the medical officers to take the initiative in making necessary recommendations.

Although there is nothing explicit in the Regulations on this subject, it is well to assume that, on account of certain technical matters involved, the medical department should act in the advisory capacity, and take the initiative whenever the occasion arises. This is in accord with our experiences at this Post (Quantico, Va.).

THE MARCH

Marching is usually a military necessity executed to bring troops into advantageous or strategic positions at or near the battle line. It is therefore necessary to take well-known precautions in order that the men may arrive at their destination in the best physical condition and not completely fatigued. The starting hour is, of course, determined by the existing necessities. Whenever possible, however, it should be in the early morning when the men are fresh and active and the air is cool and stimulating. Unless unavoidable, strenuous marching during the heat of the day should not be attempted. Night marching should be practised only when military necessity demands, because the depressing physical effects usually outweight the advantage of strategic positions.

Previous to the start a light meal of bread, cereals, milk,

tea, or coffee should be allowed. Marching with empty stomachs is weakening and therefore detrimental.

The length of the march for a division or a brigade under normal conditions should not exceed 12 or 15 miles daily. The length of a day's march, however, is not measured by miles, but according to the condition of the roads, the weather, the pace, the loads carried, etc.

The rate of the march should not average more than 2½ miles per hour, inclusive of stops; more than this will lead to fatigue and exhaustion. To average this, 120 30-inch steps a minute are required. The march should be at route order, in open ranks, half on each side of the road. This decreases the heavy, devitalizing cloud of dust, foul odors, water vapor from perspiration, etc., which tends to hang over close-order ranks. The march should end with the same equal pace with which it started; the frequent "final spurt" should not be invoked as, at this stage, it is doubly depressing. The men should alternate between marching in step and at ease; singing and whistling popular tunes is to be encouraged. This distracts their minds from their fatigued condition, and is probably the surest way of preventing early exhaustion. Straggling, either from poor discipline or fatigue, is always to be avoided, as it is depressing to the "morale" of the entire body of troops.

In hot weather coats should be unbuttoned or removed on the march but replaced at halts. The position of the body should be inclined slightly forward, similar to the position in mounting a flight of stairs. This is especially to be advised if the soldier is carrying his full equipment. Marching rigidly erect necessitates the expending of greater muscular effort and therefore early fatigue.

Smoking on the march has a depressing effect on the physical condition of the men, particularly upon the heart and lungs. It also had a tendency to cause the mouth to become dry,

creating excessive thirst. This practice should be strictly prohibited.

Before the start only the average amount of water to a meal should be ingested and the water bottles filled with water, unsweetened tea, or coffee. Following this, the canteens should not be resorted to until 7½ miles have been covered. The contents should then take the men to the end of the 15-mile march. The bottle should again be refilled at the end of every subsequent mile. The average normal requirements are one quart of water at the end of every 7½ miles.

The experienced soldier will march nearly all day with only an occasional recourse to his water bottle, and then drink very sparingly. The young and unwise will drink excessively every few miles, and as a consequence becomes "water-logged," perspires freely, tires easily, and refills his bottle from every strange, perhaps heavily contaminated, stream along the wayside. Water bottles should not be filled at these streams until the quality of the water is approved by the medical officer.

A fairly satisfactory method of allaying the thirst while on the march is to suck on a small pebble placed in the mouth, to excite the flow of saliva, at the same time breathing through the nose.

A few words on flexion, or bent knee marching might not be out of place. This is a method advocated by de Raoul and is patterned after the oriental couriers and footmen. In this type of marching the body is bent forward at the hips, and the legs are bent at the knees, in such a manner that it gives the marching man the attitude of almost falling forward at each step. The displacement of the center of gravity of the body forward serves automatically at each step to drag the weight of the body along.

Unless this method is thoroughly understood, and is system-

atically developed, any attempt to change the method of marching, which each soldier has developed as his peculiar, individual type, may not be productive of the best results.

To Lieutenant S. A. Folsom, MC, U. S. Navy, is acknowledged credit of the preparation of the major portion of the following chapters.

TENDENCY TO PROCURE A SMALLER SHOE THAN NECESSARY

For some reason there appears to be a tendency inherent in the human race to procure a casing for the foot which is too small.

As an extreme example, illustrative of this fact, it may be mentioned that the growth of the foot of the Chinese gentlewoman is stunted from infancy by tight coverings. This trait is again illustrated by the modern woman wearing a tight shoe, with a short vamp and a high heel, causing the foot to be extended, which gives it an appearance of brevity. The male members do not escape this tendency, not even in a military organization. An examination of several thousand men on this station reveals that about 80 per cent. were wearing shoes which were too short.

The public is apparently awakening to this error, judging from the number of advertisements of the so-called orthopedic shoe, appearing in the current magazines, and are endeavoring to correct the same. However, the faults of a lifetime cannot be remedied in a day or a week but requires the wearing out of at least one pair of properly fitted shoes before satisfactory results may be expected.

Conditions Afloat.

While the material in this book may be considered of primary importance to the Marine Corps on expeditionary duty

yet there may be numerous occasions where these remarks are equally applicable to officers and men of the Navy.

In naval training stations and where members of the navy form landing parties, the necessity of properly shod feet is obvious.

Aboard ship, in the period of the four hour watch, officers and men often cover rather long distances in walking to and fro on the hard decks. But on occasions like this the feet support only the weight of the body and there are no heavy impediments to cause an exaggeration of any minor defects of the foot gear. This favorable condition is, however, partly offset by the fact that there is little resiliency to a steel or wooden deck as is apt to be present when a command is marching on land.

All things considered, improperly fitted shoes may not result in as large a percentage of foot injuries among those afloat as in an infantry organization, yet such defects may result in certain postural abnormalities which may produce certain well defined constitutional symptoms.

ANATOMY AND PHYSIOLOGY OF THE FOOT

The human foot, considered in its entirety, is indeed a very wonderful anatomic part of the individual. In the smallness of its size and weight, out of all proportion to the burden borne and carried, it constitutes a mobile, strong, flexible and efficient member of the organism designed to bear weight forwards, backwards, and sideways without mishap. Encased in a cloth covering, the sock, and in a protective leather covering, the shoe, both concomitants of an advancing and exacting civilization, this member, the most unintentionally neglected part of the body is fully expected to do its duty indefinitely without complaint. As with other mechanisms, mechanical

or otherwise, so with this, ignorance cannot accomplish satisfactory results.

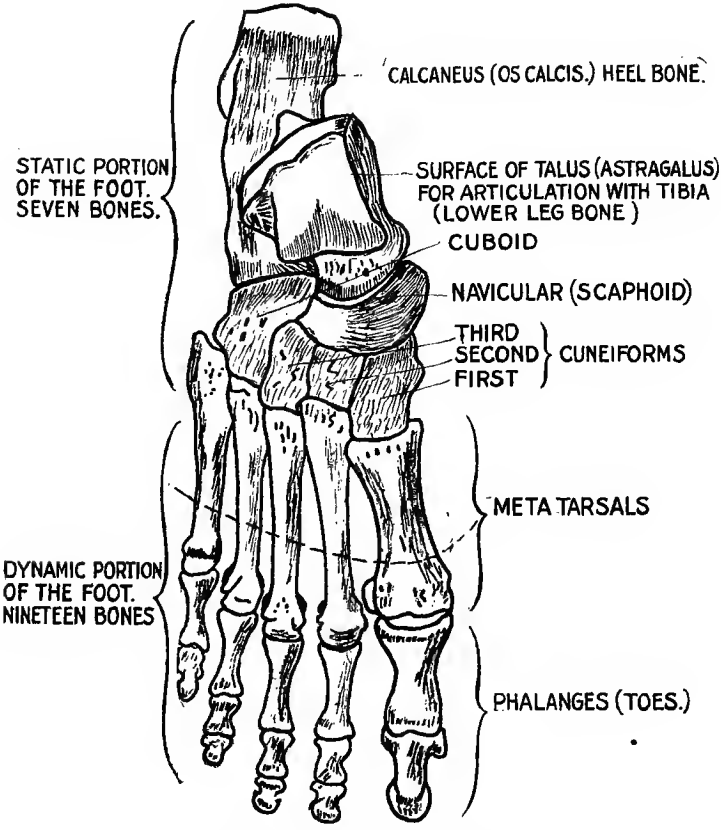


FIG. 1.—Skeleton of right foot from above. (*Cunningham.*) Dotted line shows anterior arch formed by metatarsal bones.

Concisely, the structure of the foot is composed of a nicely adjusted aggregation of twenty-six bones of various sizes and

shapes, each, however, designed to perform a certain definite function. Seven of these are of a very irregular shape and are located in the hind part of the structure forming the heel and a portion of the so-called instep. The remaining nineteen, situated in the forepart of the foot, form a portion of and radiate fan-like from the instep. These extend forward and to the outer and inner sides finally ending in the toes. (See illustration No. 1.) These different bones are held in the correct position by ligaments, tendons and muscles; the ligamentous support predominating in the posterior seven bones which form the *static portion of the foot* while muscular action predominates in the anterior nineteen bones which form *the dynamic portion*. (See illustration No. 1.) Over the dorsum or upper surface of the foot the muscles are few in number and lacking in development. However, on the plantar or lower surface filling in the arch beneath the instep there are five layers of well-developed muscles which buttress the arch preventing descent of the latter when continued and excessive weight is borne. (See illustration No. 2.)

The posterior seven bones, forming a compact mass and held by ligamentous attachments, move very slightly when a step is taken and serve to minimize the shock of impact and act as a recoil mechanism. On this mass—the static portion of the foot—in the shod man, all the weight of locomotion is first borne; first affecting the heel and center of the instep.

The anterior nineteen bones are controlled mainly by muscular action—the dynamic portion—and when in use bearing weight, move extensively. From the center of the instep the weight borne is shifted to the ball of the foot which spreads medially and laterally presenting an enlarged area to the walking medium. The toes also spread laterally, medially, and lengthen, gripping the surface. (See illustrations Nos. 3 and 4.)

FIG. 2.—Sagittal section of foot. Red masses indicate muscle layers. Note difference in thickness of muscle layers on sole of foot, under arch and on upper surface of the foot over the arch. Dotted line indicates longitudinal arch extending, on the inner side of the foot, from the heel bone to the extremity of the first metatarsal bone. The scaphoid bone, the keystone of the longitudinal arch is demonstrated. Note the concavity "*A*." (*Modified from Munson.*)

The longitudinal arch, on the inner side of the foot extends from the heel bone (Os Calcis) to the distal end of the first

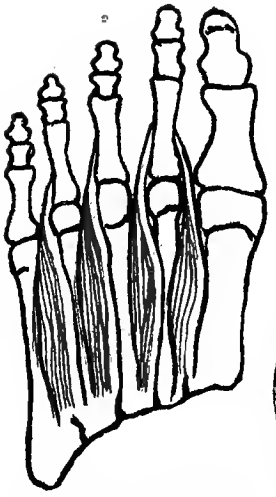


FIG. 3.—Muscles controlling lateral toe action. (*Cunningham.*)

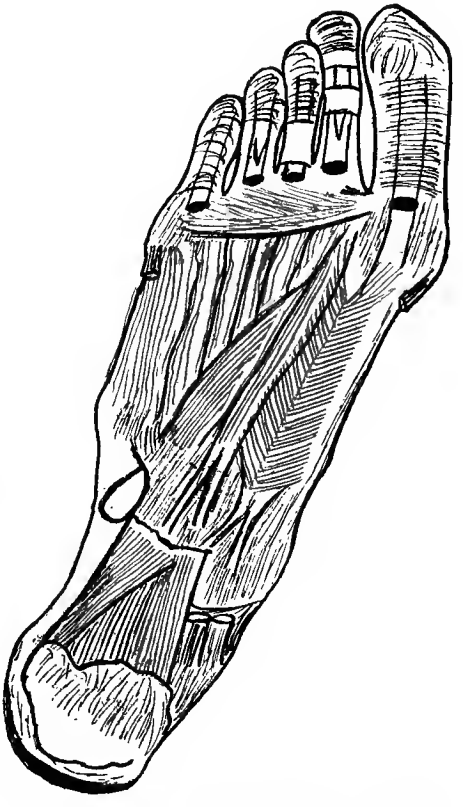


FIG. 4.—Deep muscles of foot. Muscles and tendons controlling toe action. (*Cunningham.*)

metatarsal bone. (See illustration No. 2.) This is definitely formed by the inherent structural concavity of the bones held

among themselves by ligaments and supported from below by developed muscle layers.

The anterior arch is formed by the distal ends of the metatarsal bones. (See illustration No. 5.) The muscular development concerned in sustaining this arch is not so great as in the longitudinal.

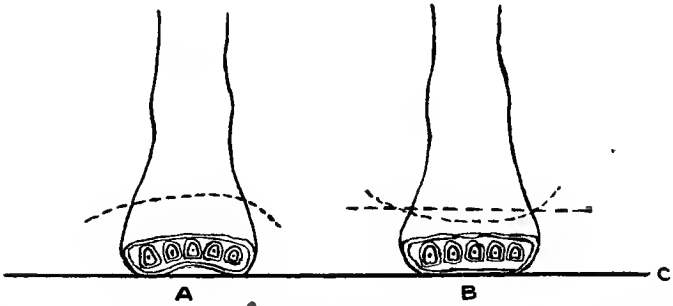


FIG. 5.—Cross section of feet showing metatarsal bones forming anterior arch.

A shows formation of anterior arch by distal ends of metatarsal bones. Note convexity of instep, dotted line indicating integrity of arch and concavity formed on the plane *C*.

B shows fallen anterior arch. Note flat or convex instep, dotted line and absence of concavity on the plane *C*.

A tripod is formed by the structure of the foot; the apex of which is the highest point of the heel bone (Os Calcis), the inner side of the ball of the foot at the base of the big toe (distal end of first metatarsal bone) and the outer side of the ball of the foot at the base of the little toe (distal end of the fifth metatarsal bone). (See illustration No. 6.)

A comparison of the feet of the shod man and the bare footed savage is interesting and instructive. In the shod man the joints are not as flexible, the muscles are not as well developed and the toes in walking do not spread and grip; being limited by the shoe. Taking a step he strikes the heel

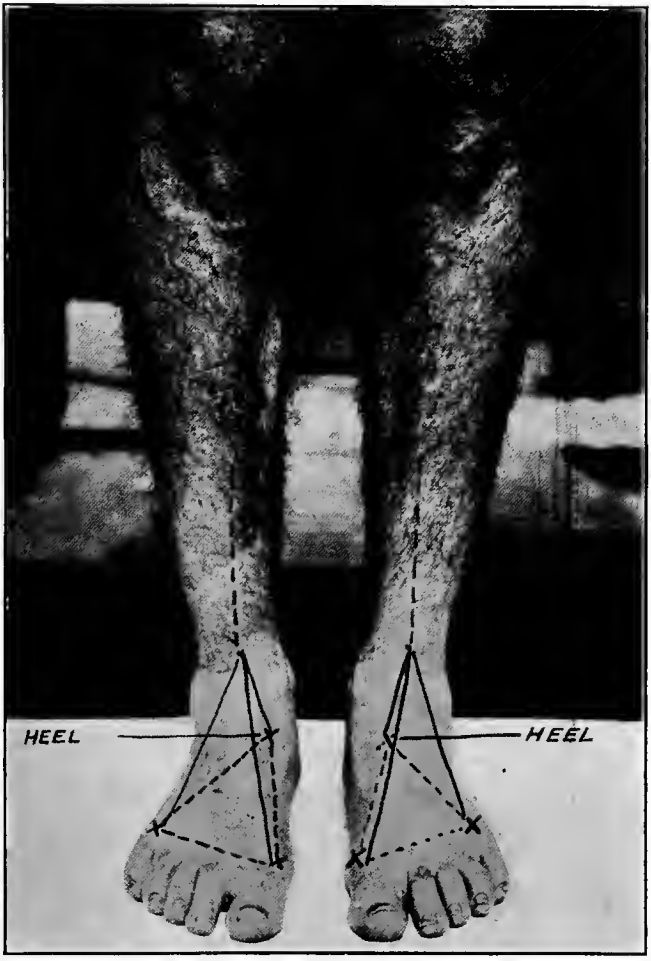


FIG. 6.—Anterior view of feet and legs showing tripod formation, correct foot posture and position of normal ankles.

first, shifts the weight to the outer border of the foot, then full upon the ball while the toes as above explained, are limited in their motion. In that the shoes limit the bearing surface of his feet he "toes out" sometimes slightly, other times excessively, to preserve his equilibrium, thus throwing the weight borne backward on the inner border of the foot—on the arch—where it should not *all* be borne. (See illustration No. 9.)

On the other hand, the savage has very flexible joints, well developed muscles under the arch as are also the muscles of the calf of the leg. In locomotion he has his feet parallel—the correct posture—or "toes in" throwing the weight upon the ball of the foot, center of the instep and outer border of the foot. His toes unhampered by a covering spread widely, lengthen, grip the surface, and thrust vigorously backwards. He walks on soft, nonresistant earth which conforms itself to the irregularities of the foot forming an accurate impression which lessens the strain on the muscles and ligaments and minimizes the shock of impact. The reverse is true in the civilized individual who, his feet encased and limited in motion by a covering the bottom of which does not conform to the irregularities of the foot, walks the greater part of his life on macadamized roads or rock pavements where muscle strain and shock of impact is great.

DEVELOPING THE FEET OF THE RECRUIT

Upon the physiological development and muscular efficiency of the recruit's feet depends largely his future usefulness as a soldier. He is made or broken in the training camp. Comparisons are helpful in explaining a delicate situation. Just as the professional weight lifter can not and does not develop his enormous muscles in a night or day, so it is with the foot

muscles of the new arrival in camp. The truth is, we have expected too much of the recruit and have done too little to

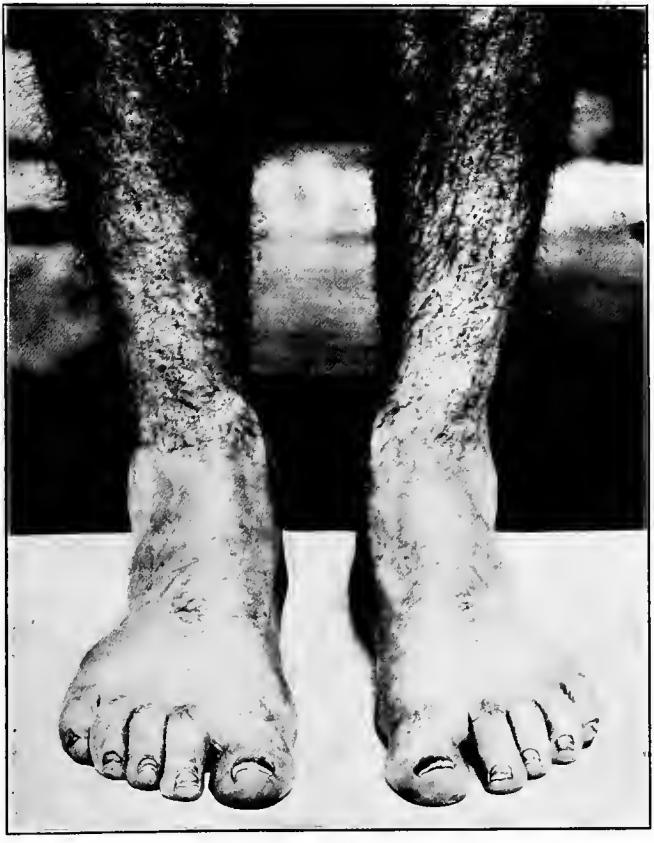


FIG. 7.—Correct foot posture.

help him. The great majority of men come from sedentary occupations in civilian life and enter upon an active pedestrial

life, when they enter the service; and we must realize their short-comings and strive to develop these men correctly if good results are to be accomplished. The greater part of the

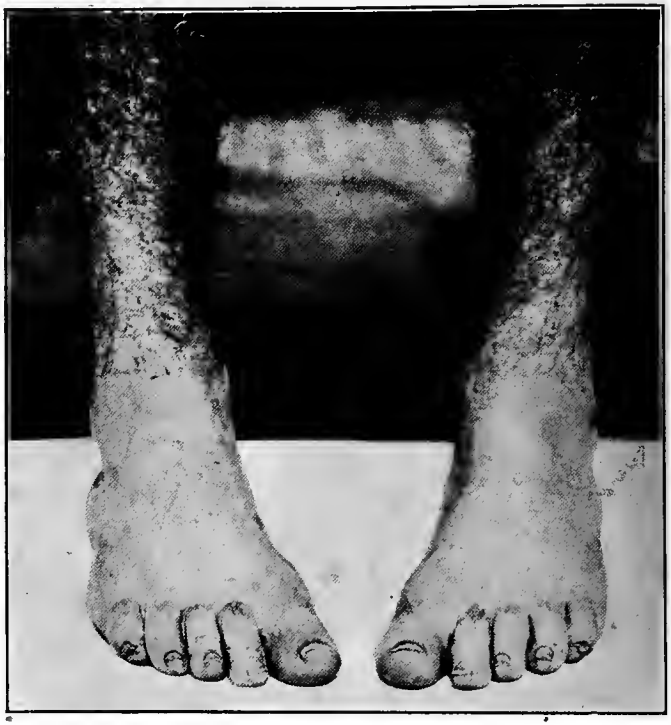


FIG. 8.—Incorrect foot posture. "Toeing in." Pigeon toed.

responsibility of developing this raw material depends primarily and essentially on the line officer, who, if he is to turn out the largest number of fighting units, must know this subject and apply it in practice. That failure has often played a

great part is evidenced by the numerous examples of men disabled by foot trouble on the sick-list and awaiting survey. These men represent a loss of time and money to the government and are deadweights and incumbrances to the efficiency of the military machine.

FIG. 9.—Incorrect foot posture. Military position. "Toeing out."

When the recruit is first received in the service, careful and accurate measurements should be made of the feet, sock sizes estimated and shoes fitted. The work done in these formative periods must be graduated; that is, the distances marched or hiked and equipment borne must be gradually increased.

This is done to develop the muscles of the feet, especially under the arch in the sole of the foot, and is left to the discretion of the officer in charge, advised by the surgeon.

At the end of about three months the feet should be remeasured, sock sizes re-estimated and shoes refitted. Why? Because the muscles of the feet have developed and the feet are thicker, broader and longer, so that the previous procedure does not suffice. After this second measurement and fitting, the same size shoe and sock may be worn as long as the individual is in the service; exceptional instances requiring a third measurement and fitting which should be done if complaint is made.

ANATOMY OF THE SHOE

To know a shoe and to appreciate fully it's construction internally and externally one must necessarily know the names of the different parts. The parts of the shoe, externally from being forward are: the lifts of the heel, face of the heel, breast of the heel, waist or shank, sole, welt, vamp and upper. (See illustration 10.)

The best way to study the internal construction of a shoe is by a cross-section. In a cross-section the following parts of the shoe are to be seen; the sole, welt, thread holding the welt, upper and insole together (Goodyear Welt), drill lining and vamp of the upper. (See illustration 11.) There are four standard types of internal shoe construction. They are the following:

1. Goodyear welt.
2. McKay sewed.
3. Standard screw.
4. Pegged.

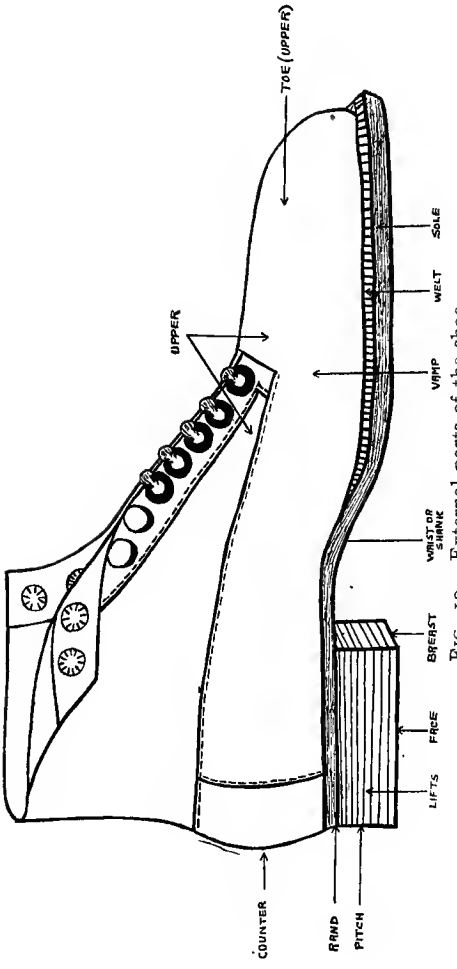


FIG. 10.—External parts of the shoe.

Of these four types the Goodyear Welt is the most widely used and universally adopted shoe. In manufacturing the Goodyear Welt shoe the tacks in the lasting are all withdrawn and a machine with a curved needle sews the welt and upper to the insole without entering the shoe cavity. The heavy outsole is then stitched to the welt. (See illustration.)

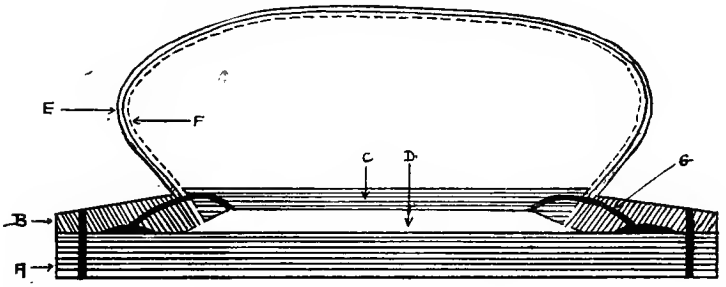


FIG. 11.—Goodyear welt shoe. Cross section. Sole, welt, insole and fill exaggerated.

A = Sole.
B = Welt.
C = Insole.
D = Fill.
E = Vamp.
F = Drill lining.
G = Thread (Goodyear welt feature).

This type is superior in its construction to all others for the following reasons:

1. Smooth surface inside.
2. Most durable, efficient and comfortable shoe.
3. Outsole can easily be renewed.

CARE OF THE SHOES

Badly Fitting Shoes.

Where the shoe is either too large, too small, or too old with wrinkled and broken drill lining there inevitably results

friction, pressure and impact. These three factors are paramount in the causation of callosities, corns, blisters, abrasions. tender and sore feet. So, in the examination of a shoe searching for the causative agent of foot disability, the fact that the shoe may be too large, too small, or too old, should be borne in mind. The part that the socks play will be discussed under that heading.

Where the injuries above enumerated occur the shoe should be examined thoroughly for the points mentioned:

1. Top of toes—toe cap too low, leather stiff, improper construction;

2. Ends of toes—shoe too short, loosely laced, improper construction;

3. Outer sides of big and little toes—shoe too narrow across the instep.

4. Over the instep—tightly laced shoes, uneven wrinkled tongue;

5. Along the outer and inner margins of the sole of the feet—faulty internal construction resulting in thick inner edge of insole or warping or curling of the latter.

6. On the sole of the feet—inequalities of the inner sole caused by the warping of the leather or shifting of the fill (layer below the insole.)

The shoes being the most important part of the soldier's equipment and the back bone of an infantry organization's efficiency; it is essential and imperative that an elementary knowledge, at least, of their care be part of the officers knowledge. This knowledge should be imparted to the men at each and every opportunity where the occasion offers itself.

To make the foot covering as water-proof as possible under ordinary conditions the sole and welt should be thoroughly oiled with neatsfoot oil, bacon rind (salt removed by soaking) or in emergencies with machine oil of good quality as used in

the lubrication of the rifle. Where constant exposure to water and cold is anticipated the upper as well should be thoroughly oiled by application of the oil and rubbing and kneading of the leather. Judgment, however, should be practised in oiling the uppers because too much oil is a detriment, in that it clogs the pores of the leather making the latter impermeable and preventing the moisture of the foot from evaporating. This condition of the shoe, then, is comparable to rubber which is also impermeable.

Where the shoes have become water soaked from continued wetting do not place them too near a fire as such quick drying causes stiffness and hardness of the leather with the production of corns, blisters, abrasions and similar affections. From the action of rapid drying, also, it should be noted that the leather decomposes and disintegrates quickly lessening the life of the shoe. Where haste is necessary pebbles may be heated and repeatedly placed in the shoe and agitated until a sufficient degree of dryness has been obtained. Hot cloths may be placed in the shoe or oats which absorb moisture readily. The shoes being dried by what ever method chosen, they should be thoroughly brushed and the leather kneeded with the fingers until supple. Wet shoes should never be exposed to the elements in freezing weather as the leather will become frozen. Should the shoes issued be lined with drill ducking this should be examined frequently to see if it is torn, wrinkled or lying smoothly in the shoe cavity. Dress shoes used for liberty should be kept brushed and polished constantly if long life is to be expected of the leather.

As a preventive measure troops should be urged to examine the shoe cavity for protruding nails, wrinkles of leather or drill ducking and other inequalities of the surface. Broad laces should be used and laced sufficiently for the march to hold the heel in place and prevent shifting of the foot forward in the

shoe. The tongue of the shoe should be smooth, free of wrinkles and lie evenly under the laces.

SHOE-FITTING

Fitting and Care of Socks.

The practical importance of correctly fitting socks to the infantryman can hardly be justly estimated as no matter how much care and judgment is exercised in fitting shoes all this work is for naught if the cloth foot covering is too large or too small. The inevitable conclusion is thus reached, that a sock too loose or tight in a correctly fitting shoe does as much damage and incapacitates the individual as much as a poorly fitting shoe.

The way to the ideal system of fitting sock sizes to the corresponding shoe sizes is partially obstructed by obstacles which must be overcome if complete success is to be attained. Essentially, these obstacles to our progress consist of various differences which exist in socks of the same weight, size and material; namely, flexibility and shrinkability. This is applicable to both woolen and cotton socks. Further, there is to be considered the multiple variations in the relative length, width and shape of the feet. Although it is readily conceivable that a sock of elastic material will be conformed to the shape of the foot, yet there is to be considered the fact that the different materials after repeated washings will not sometimes do this. An ideal material whose definite elasticity and shrinkability is predetermined accurately, and reservations made for variations, will do much toward establishing some fundamental plan for fitting socks accurately.

At the present time a general plan consisting of a "Sock Size Scale" which corresponds to different shoe sizes has been adopted to remedy as much as possible the existing evil of

ill-fitting socks. This scale can be readily understood by reference to the plate in this Chapter.

Shoe Size	Corresponding Sock Size
5	
5½	10
6	
6½	10½
7	
7½	
8	11
8½	
9	
9½	11½
10	
10½	
11	12
11½	
12	
12½	12½
13	
13½	
14	13
14½	
15	13½

Acutely realizing the present situation, and endeavoring to obtain some definite information as to the degree of variation in socks of the same weight, size and material after repeated washings a series of experiments were conducted at this Post (Quantico, Virginia). Standard Marine Corps socks (size 11) of Heavy Woolen, Light Woolen and Black Cotton were used.

These experiments were made to determine:

1. The amount of shrinkage in cotton and woolen socks;

2. The amount of flexibility lost in cotton and woolen socks;

3. The effect of temperature on the amount of shrinkage and loss of flexibility in cotton and woolen socks.

The material of the socks used was as follows:

1. Heavy woolen. Yarn. Gray worsted, made from not less than pure ⅜ blood wool;

2. Light woolen. Yarn. White. Commercially known as merino, composed of 50 per cent. wool and 50 per cent. cotton.

3. Cotton. Yarn. Black. Uniform quality of yarn, best "peeler" or equally long staple cotton free from impurities and full combed.

Tests were as follows:

Heavy woolen, light woolen and cotton socks each washed three times at same temperature. Three temperatures were used 212, 200, and 75 degrees Fahrenheit respectively. Ivory soap was used.

The greatest amount of shrinkability and lost elasticity was found in the Heavy Woolen Sock. After the first washing at 212 degrees Fahrenheit and immersion for fifteen minutes, shrinkage of one inch in height, one inch in width and one and and one-half inches in length were noted. Second and third washings at 212 degrees Fahrenheit caused a further shrinkage one inch in height, half inch in width and half inch in length. Total shrinkage after three washings at 212 degrees Fahrenheit as follows:

Height (from heel to top of sock leg)	2 inches
Width	1.5 inches
Length	2 inches

Total loss of elasticity noted as follows:

Height (from heel to top of sock leg)	3 inches
Width	2 inches
Length	2.5 inches

Washings and immersions in temperatures of 200 and 75 degrees Fahrenheit caused very little shrinkage and loss of elasticity. Boiling seems to play a great part in the production of shrinkage and lost elasticity.

In the light woolen socks after three washings each in the different temperatures as given above there was a total shrinkage noted as follows:

Height (from heel to top of sock leg)	0.5 inches
Width	1 inch
Length	1.2 inches

Total loss of elasticity noted as follows:

Height (from heel to top of sock leg)	1 inch
Width	1.5 inches
Length	2.3 inches

The total amount of shrinkage and lost elasticity in the cotton cocks after three washings and immersions at each temperature was very inconsiderable and not worthy of note.

CARE OF SOCKS

When being fitted for shoes the individual should wear the light woolen sock which is preferable for general use about the barracks and on the march. In cold weather when a heavy woolen sock is to be worn larger shoes are necessary to prevent foot disability. Socks that are too small cramp the toes and produce a result identically the same as pointed narrow shoes. On the other hand large socks take up needed foot space in the shoe; and forming wrinkles produces painful blisters and abrasions.

On the march every man should carry at least *three extra pairs of socks*. They are a necessity; and being light in weight can be easily carried. Manifestly, they are a most important

part of the equipment. No socks which have been darned or socks with holes should be used on the march. Immediately after washing the feet the socks should be washed, dried and stretched before using again. Where facilities for washing are not at hand they can be dried, kneeded and stretched. Changing of socks from one foot to another is advisable where time is available.

MILITARY FOOT INSPECTION

The recent great conflict, despite the abundant means of mechanical conveyances, has demonstrated that the days of marching are not over; and has shown vividly and most impressively the extreme prevalence of minor foot ailments occurring not only on the march, disabling and incapacitating many otherwise useful men, but also in the barracks resulting from drill and extended guard duty. These disabled men, often numerous, most assuredly must not all be sent to the Medical Officer who would be overcome by the weight of numbers and unable to give each man adequate and individual attention. Again, he would be prevented from accomplishing other important work connected with the organization. The Medical Officer should supervise the work of prevention and remedying of foot ailments; only attending personally to the severe cases. To these he can give his undivided attention procuring quicker and better results and thus lessening materially the total number of sick days. The urgent need of today is men trained in the remedying of minor foot ailments and apportioned to different organizations according to the strength of the latter. Those interested in this subject have proposed that selected enlisted men, but preferably hospital corpsmen, with some previous medical experience be trained and instructed in a school of foot care at the central training

post of the Corps; and from here sent to different minor posts and organizations on duty in the tropics and elsewhere. These men, however, would perform their regular duties in addition to this special detail. Working under constant supervision of a Medical Officer the work would be correctly done and much benefit derived therefrom.

TECHNIQUE OF TREATING MINOR AILMENTS OF THE FEET

In this, as in other work pertaining to incision and manipulation of the tissues, scrupulous care must be taken that infection does not occur. This will not occur if blood is not drawn and cleanliness and antisepsis are practised at all times.

Infection occurring in the feet because of the attendant circumstances is often severe. This should be especially remembered. The measures to be taken consist of:

1. Cleanliness and disinfection of the attendant's hands.
2. Cleanliness and disinfection of the instruments.
3. Cleanliness and disinfection of the part.

The hands and forearms up to and above the elbows should be thoroughly scrubbed with soap and hot water where procurable and the latter frequently changed during the process. The brush should be sterile, made so by boiling. Special attention in the scrubbing should be given to the folds and creases of the skin, and to the spaces around and beneath the nails. Rings should be removed from the hands. Lastly the hands should be scrubbed in seventy per cent. alcohol for five minutes.

Instruments should be kept in case provided for the purpose and well covered with liquid petrolatum or vaseline when not in use to prevent rust. When use is demanded wipe free of oil or vaseline with clean gauze and wash in hot water and

soap to remove last vestiges of grease. Knives should not be boiled as boiling tends to dull sharp instruments. Sterilize by placing in a five per cent. solution of carbolic acid for twenty minutes and then transfer to eighty-five per cent. alcohol.

Part should have been previously cleansed. Apply tincture of iodine three per cent. Allow to dry. Then apply alcohol seventy per cent. Iodine is an admirable antiseptic which penetrates the epidermis and fixes the bacteria in the skin.

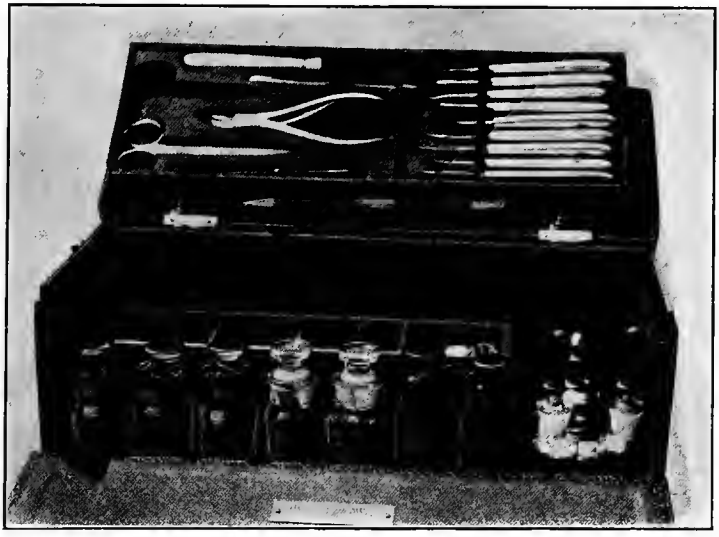


FIG. 12.—Foot inspector's case used in expeditionary work of the United States marine corps.

CLEANLINESS OF THE FEET

The first essential in the proper care of the feet, as of the body, is rigid attention to cleanliness. Where this is neglected there accumulates an excessive amount of perspiration, fatty material, dirt and skin scales which under the action of bacteria

decompose causing a very offensive odor and the skin to disintegrate. The individual then suffers from abrasions, blisters, tender, sweaty and flaccid feet.

To maintain a standard of cleanliness and relative freedom from foot trouble and disability, inspections should be made. In the barracks this inspection should be made at least every fortnight. The company commander, accompanied by the sergeant who takes notes if necessary, passes through the barrack houses inspecting each man as he stands in his bare feet at the foot of his bunk. This can be accomplished in a very short time if the method is systematized. Some will maintain that this is repugnant and beneath the dignity of an officer. But the same is true of many other things in military life. Surely if cavalry officers take scrupulous care of the hoofs of their horses, infantry officers can do the same with the feet of their men. One is just as important as the other.

In the field, inspections are even more imperative. The feet should be inspected before and after every march so that all minor and trivial injuries can be attended to promptly and prevented from becoming serious disabling affections which cripple the efficiency of a command.

Daily foot baths of cool or tepid water with just enough soap to cleanse should be taken. Do not soak the feet as this softens the skin. If household ammonia is procurable a few drops of that in a basin is advisable. Cool or cold water is to be used because it not only hardens the skin and eases the sensation of burning after a march but also increases the tone of the foot. By tone is meant a stimulation whereby the muscles are held in a state or condition of continuous contraction ready to respond quickly to the slightest call. After a cold bath we all feel much better and anxious *to do*. This condition in modern terminology is called "pep." So let us

say that cold water gives "pep" to a tired foot. After washing of course the feet should be thoroughly dried.

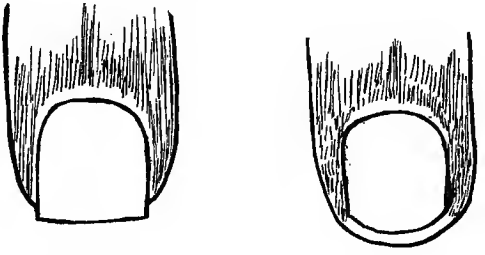
In the field the feet should be washed and the socks changed before and after every hike. Water is usually present in the form of springs, wells or streams. By scraping a hole in the ground over which is spread a poncho, a suitable basin is readily made into which water may be poured from a canteen.

FIG. 13.—Poncho basin as used in the field.

Where water is scarce just a few spoonfuls poured on a towel, handkerchief or paper and applied between the toes suffices. In extreme cases saliva on a handkerchief can be used to advantage.

Both in the past and at present the nails according to an unassailable custom have been cut "round." The corners should not be trimmed off as this encourages a nail to grow into the flesh resulting in an ingrown nail. Nails should be cut

straight across about every two weeks. Nails deformed by overgrowth, such as unusually thick nails and clubbed nails, can be remedied by soaking in hot water and paring down with a knife or rubbing down with sand-paper. The material under the nails should be removed with an orange stick, not with the point of scissors and the like.



Correct way. Incorrect way.

FIG. 14.—Trimming of toe nails.

BLISTERS AND ABRASIONS

The most common causes of blistering are: *friction*, *pressure* or *impact*. Accessory causes are ill-fitting shoes and socks, overriding toes, hammer toes, poorly constructed uneven cheap shoes, heat, moisture and uncleanliness. They are most often found in those whose foot skin is tender and soft, *e.g.*, among newly recruited troops and those not accustomed to long hiking. The points usually affected are: the outer surface of the little toe, upper surface of the toes, surface and back of heel, upper surface of foot under the shoe-laces, ball of the foot and over the Tendo achillis (the large tendon attached to the upper surface of the heel bone). The formation of blisters is a protective process. Irritation of the outer or false, and inner or true skins being continuous, there arises an inflammation of both, during which, the inner skin exudes

an inflammatory fluid and raises the outer thus forming a blister.

Treatment is directed primarily toward the cause. Inspect and remedy defects in the shoes or socks, such as nails, fallen toe cap, ill-fitting insoles, worn lining, tight lacing, uneven stitching as over the Tendo achillis posteriorly and badly worn, darned, small or dirty socks. Apply to blister tincture of iodine 3½ per cent. or grain alcohol. Immerse needle in alcohol or heat in flame and puncture at the base, allowing fluid to escape and covering (outer skin) to collapse on the inner or true skin thus protecting the latter and minimizing infection (invasion of microbes). The blister (outer or false skin) should, therefore, not be torn or removed.

Dry the skin with gauze or absorbent cotton and cover the blister with adhesive plaster which should be firmly pressed down so that the raised outer skin or epidermis will be forced into position. The adhesive may be made to stick well by heating it with a match or applying ether if the latter is to be had. Should it be impossible to procure adhesive plaster, then sterile vaseline, boric acid ointment or zinc oxide ointment may be applied with benefit. If these last-named articles are at a premium, the regulation foot-powder may be dusted on the part and a few turns of a gauze bandage made. All the dressings being completed, a moderate amount of the foot-powder should be dusted on them and in the shoe. The powder prevents the edges of the adhesive from adhering to the sock and lessens friction in the shoe cavity. Too much powder is just as bad as none at all as a large quantity tends to cake and form uneven surfaces. Search should be made for all areas which are red and tender with no formation of blisters. Adhesive plaster should be placed over these.

Heel blisters occupy such a prominent place in the category of transient foot ills that they should be given careful attention.

Usually caused by bad socks or poorly constructed ill-fitting shoes allowing the heel to slip, they form by far the great majority of blisters. The structural defects of the shoe are usually such as (*a*) heel too narrow or broad (*b*) shoe too long (*c*) shoe too broad across the instep with high heels (*d*) incorrect posterior curve of shoe not conforming to heel and tendon and (*e*) improper lacing. In the individual with a long, narrow foot and narrow heel, or the one with a broad foot and narrow heel. much benefit can be derived by placing a felt pad varying in thickness, corresponding to the tongue of the shoe in size and posterior to it. The greater part of these blisters will be avoided by a proper measurement and fitting where the heel is regarded with more care. The figure-of-eight marching strap, originally devised and used by the French, will prevent the heel from slipping up and down, on the march in the great majority of cases.

Abrasions are nothing more or less than blisters with the raised outer skin or epidermis removed exposing the rose red derma or inner skin. They are very painful due to the fact that the sensitive nerve endings in the derma or inner skin are unprotected and exposed to changes of temperature and injuries. In the blister, on the other hand, these nerve endings are protected by the raised epidermis and accumulated inflammatory fluid.. The causes of abrasions correspond to the causes of blisters. The treatment is primarily corrective. The cause should be sought for and remedied. Protective treatment includes the applying of alcohol (grain) or iodine $3\frac{1}{2}$ per cent. to the area then zinc oxide adhesive plaster. In lieu of the adhesive plaster zinc oxide or boric acid ointment may be applied plus a few turns of a gauze bandage.

In the prevention of blisters and abrasions there are three factors which determine the functional integrity of the foot:

1. Proper measuring of feet and fitting shoes.
2. Proper corresponding sock—size.
3. (*a*) Feet inured to hiking or (*b*) prepared for such.

The proper measuring of the feet and accurate fitting shoes together with the correct corresponding sock-size will be discussed in full later. That feet inured to hiking will escape much injury is self evident. At this point, however, should be mentioned the application of formaldehyde Sol. 10 per cent. on alternate days for six applications to the soles of the feet and especially points exposed to pressure. This serves to harden the skin and lessens the chance of inflammation. Adhesive plaster may be placed over suspicioned pressure points before the march to escape the formation of blisters together with the same weight socks the shoes were fitted with.

FOOT STRAIN

Because of the inherent facility of the layman to attribute any and every foot ill to flat-foot or a tendency thereto, many of the uninitiated and inexperienced, influenced by the popular trend of belief, readily diagnose this condition as such. That such a step has a very decided and marked effect on the neurotic individual, and gives many persons the golden opportunity to malinger, is self evident.

To begin with, the reader should thoroughly understand that this affection is often associated with a visibly normal foot or foot posture where the ligaments have not "given" or stretched; or with a visibly abnormal foot or foot posture where the ligaments have "given." In short, the condition may be functional or organic. Whenever there appears a local, reddened, painful swelling in addition to other symptoms infection should be suspected.

This condition usually occurs in the case of the raw recruit, from a recent sedentary occupation, whose foot muscles have

not been given the chance to develop gradually. However, it may happen in an individual, a veteran may be, who has recently recovered from some debilitating infectious disease with a consequent loss of muscular tone and strength, or in the hardened soldier who has been marched far past his limit of endurance. Exceptions occur where the gradually trained man is affected during his period of training despite all precautions. These exceptions depend upon individual physical idiosyncracies.

Where a burden is borne by muscles not developed to meet that special requirement and where the muscles are not given a sufficient period of reaction or rest there results a condition of muscular fatigue, acute or chronic. Together with this there may be some tearing of the fibers constituting the muscular bundles due to overstretching of the latter. The muscles, being fatigued or torn, fail to support the burden and shift the responsibility to the tough fibrous ligaments. These are not supplied by nerves; give no sensation of pain, and are inelastic. Because of their inelasticity weight applied directly causes a transmission of tension to the periosteum (covering of bone) to which they are attached. The periosteum being richly supplied with nerves and having traction applied to it give rise to the sensation of pain. The degree of pain will vary according to amount of traction exerted by the ligaments on the periosteum. According to the weight borne, degree of strain and consequent shifting of the burden to the ligaments will depend whether the latter stretch or not. This whole sequence of events, as described, may be caused by an excess of use or load for that individual, or use in an improper manner.

The symptoms are very inconstant, elusive and deceiving at times. Pain and soreness may occur under the arch, over the arch, surface of the heel, ball of the foot, outer border of the foot or in the calf muscles. Characteristic of the pain is its

sudden acute appearance, and increasing intensity when use is attempted. This pain often severe and lancinating may skip from place to place or remain stationary. To diagnose this condition requires the attention of a surgeon. However, the condition may be suspected when the arch and scaphoid bone in examination are found well up and the muscular development of the sole of the foot is fair or good.

Feet presenting such severe symptoms necessarily conduce to inefficiency of the organization and demand the attention of the regimental or orthopedic surgeon. However, until surgical attention can be procured, simple measures may be undertaken for temporary relief in mild cases. The feet should be treated by alternatingly immersing them first into a bucket of hot water and then into one of cold water for about a period of ten minutes three times a day. This is the "contrast bath" which aids in alleviating the symptoms by bringing more blood to the part for repair of damage and also causes an increased tone of the muscles both of the feet and blood vessels. Massage, with short quick strokes, applied to the arch and other points of pain is also beneficial, and should be practised three times a day for about ten-minute periods.

The common liniments, or plain ethyl (grain) alcohol may be used.

Upon retiring at night, an elastic bandage applied to the foot and holding it in position of adduction and supination is very helpful.

To affect a static correction the heels of the shoes may be raised $\frac{1}{4}$–$\frac{1}{8}$ inch on the inner side by the insertion of leather wedges between the lifts. The use of artificial supports, extensively advertised at present, is not compatible with the pedestrial activity of military life. However, in very urgent cases, they may be used for short periods; the individual being

placed on light duty until the condition is alleviated, when the supports are discarded.

In all cases where foot strain has been incurred gradual increased exertion and weight bearing must be practised if a recurrence is to be avoided.

HALLUX VALGUS

In this condition the great toe is deflected toward the outer side of the foot accompanied by structural changes in the great toe joint (first metatarsophalangeal joint). (See plate No. 15.) With this is usually associated an enlargement of the bursa, a small sack situated on the inner side of the joint. The enlargement of the bursa, caused by an acute or chronic inflammation, constitutes what is called a bunion. Accompanying this bunion, or alone, there may occur a thickening of the periosteum (covering of the bone) forming an exostosis (outgrowth). A point of great importance, deserving careful attention, is that the anterior arch usually falls with the occurrence of all cases of Hallux Valgus excepting the mild ones.

This affection is caused by the individual's wearing pointed toe shoes of the English type in which the inner side of the sole is not a continuation of a straight line formed by the heel but curves outward thereby causing the shoe upper to press against the great toe and great toe joint resulting in deformity when worn for any length of time. The great and almost universal prevalence of this condition is due to the popularity of the pointed toe shoe.

Treatment is directed toward mitigating the condition or more radical treatment such as operative measures. The former will be discussed. Before anything is done the shoe should be inspected, the fit verified and the lining examined to

FIG. 15.—Anterior view of abnormal feet. Note depression of longitudinal arches. Marked hallus valgus.

see if there are any wrinkles present. Should the shoe be correct in fit the inner edge of the sole may be raised by the insertion of leather wedges $\frac{1}{8}$ to $\frac{3}{16}$ inch thick which throw the weight and consequent pressure away from the affected joint and toe. Again, a wad of gauze or felt pad held by adhesive, just back of the great toe joint relieves harmful pressure and permits the great toe to move more freely. In all cases where facilities are at hand the feet should be carefully measured and shoes accurately fitted.

If the shoes fit satisfactorily and are correct in other details additional comfort may be had by stretching the leather opposite the great toe joint. The military shoe with plenty of room across the ball of the foot and a sole whose inner side is a continuation of a line from the inner side of the heel will gradually improve mild cases.

HALLUX RIGIDUS

(Rigid Great Toe)

This condition involves the big toe joint and to such an extent that there is a limitation of motion, especially upward (dorsal flexion). The symptoms may be of an acute or chronic nature. Acute symptoms appear when the joint is used considerably, which use may be excessive for the particular joint involved, and consist of reddening of the skin, swelling and pain when a movement is attempted. In those cases where the acute symptoms are not present, there is a symmetrical enlargement of the joint, or at one point only, and the limited motion spoken of. These are due to the abnormal production of bone around the margin of the joint.

It is caused by pointed toe shoes of the English type, shoes too narrow for the width of the ball of the foot with high heels, and shoes too short for the individual.

Treatment primarily is corrective. Investigate the size of the socks. Measure the foot and accurately fit the individual according to the present standard. In slight cases, treatment is also directed to allaying the acute symptoms which may be benefited by immersing the foot in cold water and sufficient rest. In cases of chronic symptoms much good can be done by applying a cleat of leather, four-sixteenths of an inch to one-quarter inch thick and one and one-half inches wide to the sole of the foot back of the heads of the metatarsal bones (back of the ball of the foot.)

HAMMER TOE

This condition or deformity, usually involving the second toe, causes the middle toe to be permanently bent and project upward. As a result of this prominent upward projection, there is excessive friction with the upper of the shoe, causing painful corns. The whole toe necessarily not taking part in the gripping action of locomotion, all the burden is assumed by the end of the toe which becomes tender, irritated and finally calloused. In addition the toe-nail is often forced backward, resulting in a clubbed or ingrowing nail.

Treatment can relieve the mild cases to a certain extent. Strap a small pad of gauze or felt on top of the toe, either in front of or just back of the prominent joint. Apply two strips of adhesive tape $\frac{3}{16}$ inch wide to hold the toe straight. The first of these strips is placed, sticky side up, on the top of the toe just back of the prominent joint and then passed under the two adjacent toes, drawn comfortably taut and made to adhere; the second strip is placed sticky side down, underneath the affected toe, just in front of the prominent joint and then passed over the two adjoining toes, drawn taut and made to adhere. Refractory and severe cases should be examined and treated by the Medical Officer.

DEFORMITY OF THE LITTLE TOE

This toe has no especial peculiarities referable to its deformity. The same conditions involving the other toes, such as Hallux, Hammer Toe, Ingrowing Nails, etc., occur in a similar manner affecting this toe. The conditions being essentially the same so must be the treatment which is given on other pages.

INGROWING NAILS

These constitute a most prevalent, incapacitating, persistent and painful condition which requires immediate correction and treatment if benefit is to be obtained without operation.

The corner of the nail slopes with a curve downward and inward growing into the flesh and by pressure producing a constant dull pain. Usually involving the great toe, but not particularly sparing the others, it is often accompanied by infection with the consequent formation of pus.

The cause is essentially pressure exerted by ill-fitting shoes which are too short, too narrow across the ball of the foot and toes and too broad across the toes with high heels throwing the foot forward each time a step is taken.

Treatment primarily is corrective. Investigate the size of the sock worn. Measure the feet and accurately fit shoes. Cut the nail *squares* across and do not cut the corners round. To alleviate the pain caused by the pressure of the offending nail the following measures should be instituted. First, from in front with a sterile probe or forceps insert a small pledget of cotton under the nail between it and the flesh. Renew this every day until nail is diverted from its abnormal tendency and grows out over the toe. Again the cotton may be packed in from the side and the flesh pushed away from the nail. Crane recommends dentist's base-plate gutta percha which he

claims possesses decided advantages over cotton. This it does. First cut a small triangular piece, carefully heat it in a flame and insert under the edge of the nail. It molds itself to the shape of the parts and may be left until the nail grows in the correct direction. Where pus is present apply tr. iodine 3½ per cent., alcohol and then liberate pus with sterile needle. Cover the part with sterile gauze and send the individual to the medical officer.

SWEATY FEET

(Bromidrosis)

This condition, usually chronic, is very prevalent and is not only disabling, but also annoying and offensive. To control it heroic measures must be taken at the earliest opportunity and continued until satisfactory benefit is derived or complete cure obtained.

The sweat glands being unusually active in an individual with a very unstable circulatory or nervous system, there forms an excessive quantity of sweat which collects on the skin surface in a dried or liquid state. Mixed with skin debris, fatty material and dirt it forms an ideal culture medium for organisms which, acting upon the mass, cause decomposition. As a result of this and the constant moisture the skin becomes very soft, exquisitely tender and painful to pressure and easily comes off, thus forming blisters and abrasions. The appearance of the feet is characteristic. They are congested and inflamed with scattered areas of red and white, sometimes interspersed with a blue-purple mottling.

Treatment consists of a daily or bi-daily foot bath of *cold* water using as little of a high grade toilet soap as possible. Change socks daily or bi-daily and wear, if procurable,

canvas or cloth slippers with leather soles. Leather shoes aggravate the condition because the pores of the leather become occluded by the sweat and dirt, which forms an impenetrable barrier that prevents evaporation. Individual treatments which have been successful are as follows:

1. Wash the feet with cold water.
2. Dry carefully.
3. Carefully apply to affected areas with cotton tipped applicators the following:

(*A*) Commercial formalin (40 per cent. sol. of formaldehyd.....parts	10
(*B*) Water .....parts	90

Stillmans recommends a 25 per cent. solution of aluminum chloride in distilled water, dabbed gently on the part every second or third day and allowed to dry. This will cause rapid amelioration of the condition. Three applications are usually sufficient. If the condition recurs treatment may be repeated. Pure glycerine rubbed on the feet has been recommended. After a successful treatment, a foot powder in small quantities may be placed in the shoe.

Formula of which is given below:

Salicylic acid.....	3 parts
Boric acid.....	10 parts
Talcum powder.....	87 parts

CORNS

(Horny Thickenings of the Skin)

Corns are localized callosities or horny thickenings of the skin usually resulting from ill-fitting shoes. They are protective in nature. Where excessive impact, friction, or pres-

sure has existed there usually results an area of tenderness, a blister or an abrasion. To remedy the existing evil and to prevent a repetition, nature causes to be formed a hard horny layer of skin which protects the particular part from further injury. If the cause continues the layers of hardened skin multiply and increase the thickness of the corn. Finally prolongations downward into the sensitive true skin are formed and pressing on nerves cause pain. These callosities are most commonly found on the tops of the toes, between the toes, on the outer aspect of the little toe, on the ball of the foot under the anterior arch and on the margin of the heel.

The importance of this subject consists in its unusual and extreme prevalence; and disabling features which do much to reduce the marching ability of a military organization. The cause of corns is found in ill-fitting shoes worn at the time of examination or previously. To determine this is imperative because if the cause is not removed there will certainly be a recurrence of the condition. To remedy the latter, the shoes, if not suitable to adjustment, should be discarded or the shoe stretcher used in satisfactory shoes to remove friction and pressure.

It requires almost constant attention to bring relief from corns if their entire removal is not contemplated. The feet are soaked in warm water for a period of fifteen minutes and the corn pared down every week or so, care being taken not to be overzealous in cutting deep and drawing blood. When this is done measures must be taken immediately to check any infection because infections of the feet are very serious. Apply to the area from which the blood is oozing Tr. Iodine 3½ per cent., then alcohol and cover with adhesive or apply directly the salicylic acid-collodion. The paring of corns is a temporary, not a permanent measure, and is not recommended. To soften the horny tissue so that the whole corn will in a

short time come out and be cured permanently nothing is better than the following combination.

Salicylic acid.....	..Grains xv..... ..25 grains
Flexible collodion.....	Oz. 1. ... . 1 ounce

This is supplied by the medical department and is often superior to any patented remedy on the market. The claims of manufacturers of corn remedies to remove a corn in a night are false and the opportunity is here taken to inform officers of the service that such is so. The solution above given is inflammable and should not be near lighted matches, cigarettes, etc. The bottle should be kept tightly corked as evaporation is rapid when the contents are exposed to the air. The method of removing corns is as follows:

(*a*) Wash the foot thoroughly.

(*b*) Immerse in hot water about 15 minutes. When withdrawn note that the color of the corn is white and is soft to the touch.

(*c*) Dry the foot thoroughly.

(*d*) Apply the sa'icylic-collodion to the corn and about one-eighth of an inch around. Allow to dry. Apply another layer. Application is made with a glass rod or wooden applicator.

(*e*) Apply adhesive plaster.

This should be done on an average every day for four treatments. Sometimes even four treatments do not suffice and applications must be continued. Where the upper layer of the corn is particularly hard a thin slice may be pared off so that the salicylic acid-collodion can effect the tissue.

At the end of the course of treatment it will be found that the corn has a dead white appearance. With the end of tissue forceps or the back of the blade of a knife slide it under the loose dead skin at the margin of the corn and proceed around

the corn. Take care while prying the corn loose from the tissue not to cut the roots of prolongations which extend downward into the flesh because if these are severed the corn will recur. The whole treatment is directed toward removing the whole corn en masse with its roots and not piece-meal. Bleeding should not be caused when the corn is pulled out completely down to the derma or true skin (the quick).

The treatment described is best done while the men are in barracks; and should a march be taken immediately or soon after the sensitive areas, formerly occupied by corns, may be covered with adhesive.

As callouses and corns are similar the treatment directed to remedying the former is the same as the latter. Lastly, attention should be given to the fact that the cause, ill-fitting shoes, must be removed or the condition will recur.

CONDITIONS AFFECTING THE ANTERIOR ARCH

(Conditions Affecting the Ball of the Foot)

As a consequence of the anterior arch's falling or flattening there are two very important conditions which attract our attention. They are namely, callous formations on the sole of the foot over the heads of the metatarsal bones (ball of the foot), accompanied either with or without pain and metatarsalgia (pain in the fourth metatarsal joint). These conditions although not as prevalent as flat-foot still are of such a disabling character that their description should be given.

1. *Callous Formations on the Ball of the Foot over the Metatarsal Heads with or without Pain.*—When the distal ends of the metatarsal bones which form the anterior arch fall, they press downward upon the underlying muscles, tendons, fat and skin. Nature, to protect the skin and to form a supporting pad, causes callous to be formed which may cause exquisite pain

upon pressure similar to the familiar acute pain of the "stone bruise." The callous is formed most frequently over the head of the second metatarsal bone. In severe claw-feet, where the toes are contracted presenting high prominences on their upper surface, callosities may be present over the heads of all the metatarsal bones and give rise to great pain and disability.

2. *Metatarsalgia* (*Morton's Disease*).—In this condition there is severe neuralgic pain, sharp or burning in character, often of paroxysmal occurrence beginning on either side of the distal (far) end of the fourth metatarsal bone and passing up the foot and often up the leg. The cause is badly fitting shoes which cause the arch to fall; the metatarsal bones to be displaced and pinching of the nerves between the heads of the third and fourth and fifth metatarsal bones. The transverse arch formed by the distal ends of the metatarsal bones is flattened and the foot broadened; there may or may not be flat-foot (See illustration No. 5).

The pain usually comes on when walking is attempted and is often so severe as to cause the patient to immediately remove the shoe and rub the foot.

Treatment. The cause of both conditions being essentially the same, and since they are often associated, their treatment is practically identical. Relief may be had by mechanically supporting the depressed arch. Where the pain is acute, and temporary relief is imperative, resort may be had to adhesive straps applied transversely back of metatarsal heads (ball of foot) over properly shaped gauze or felt pads. Supports as used in civil life are incompatible to the activity of military life. The best appliance, in military life is a cleat of leather one-fourth of an inch thick and one inch wide fastened to the sole of the shoe just back of the metatarsal heads. (Ball of foot).

AFFECTIONS OF THE HEEL

The affections of the heel in order of their importance are:

1. *Tenosynovitis* (inflammation of the heel tendon and sheath).
2. *Bursitis* (inflammation of the little sac lying over the heel tendon).
3. *Periostitis* (inflammation of the coyering of the heel bone at the point of attachment of the heel tendon).
4. *Exostoses* (outgrowths of bone commonly due to a previous infection of gonorrhea).

The cause of these conditions is usually mechanical; being due to badly fitting shoes or leggins causing friction and pressure In tenosynovitis, which by the way is very common in foot roops, there is swelling and tenderness along the tendon associated with a grating sound which may be elicited if the hand is placed on the tendon involved and the foot moved up and down. Where bursitis exists there are tenderness, swelling and signs of fluid; in periostitis there is usually not much swelling but extrene tenderness is found at the attachment of the heel tendon into the heel bone and may involve the surrounding bone. Exostoses may or may not be felt. Diagnosis usually made by *x*-ray, chronicity and previous history of gonorrhea.

Treatment. Remove primarily the excessive pressure or friction by new shoes or leggins or adjustment or the same. Strap pads of felt or cotton to the leg just above toe point involved when the tendon is affected and just below when the bursa or tendon attachment is involved. Alternately immersing the foot in hot and cold water—"contrast baths"—often does good. Strapping adhesive tape two to three layers thick transversely across the tendon is of benefit in tenosynovitis. The heel may

be raised, to relieve the strain, one half to one-quarter of an inch. In acute cases where the pain is exquisite and walking impossible, rest is imperative; which, combined with hot compresses and massage of the neighboring parts, avoiding

FIG. 16.—Normal feet (shoe wearing). Note position of ankles (inner sides), convexity of instep over anterior arch. Slight hallux valgus (outward deviation of both big toes).

the irritated area itself, is of benefit. Symptoms are sometimes slow in disappearing but patience must be practised and care taken if a recurrence is to be avoided. Cases associated with infection are very stubborn and should be referred to the surgeon.

PES PLANUS

(Flat-foot)

In discussing a subject more or less well known to the public conservation should be practised if undue emphasis and incorrect impressions are to be avoided. It cannot truly be said that this subject does not deserve emphasis and impression—it does. However, on the other hand, one should not be led to believe by the flamboyant statements of those interested for financial reasons that this condition is common to the degree that one-half of our manhood is thus affected. Such statements and insidious advertising are made for a purpose. The impression I wish to make here is that every little ache and pain in the arch of the foot or leg is not a forerunner of this condition. Such symptoms may mean nothing but a tired foot; a condition of foot strain or bruised foot. A diagnosis of this condition cannot be made by the symptoms presented.

An accurate diagnosis requires more than symptoms and a casual inspection of the foot. It has been found by extensive use at this camp (Quantico, Va.) that the method described by Dr. Edward A. Rich of Washington, D. C. has been most efficient in diagnosis and altering shoes to fit abnormal feet. He has rightly said, "The diagnosis of the static foot defects has always been made largely by guess. Diagnostic aids have not been commonly sought or encouraged. Many surgeons, uninterested in foot subjects, have jumped at conclusions from mere inspection, with the usual result that treatments applied have been misfits. To diagnose and classify the foot defects without graphic aids is exactly on a par with the attempt at diagnosis and classification of the chest derangements without a stethoscope." (See subject of Pedography).

The principal causes are:

1. Inherently weak and ill-developed muscles of the lower leg and sole of the foot. These muscles being subjected to the sudden bearing of excessive weight and work, or weight and

FIG. 17.—Medial view of normal foot. Note concavity of longitudinal arch.

work excessive for that particular individual, fail to support the horny arch and allow the latter to fall.

2. Ill-fitting, ill-constructed shoes causing incorrect foot posture-toes turned out. The first cause has been discussed

in Chapter 2. The second cause may be explained as follows: Where the feet are parallel in standing or locomotion the line of weight bearing runs through the center of the knee

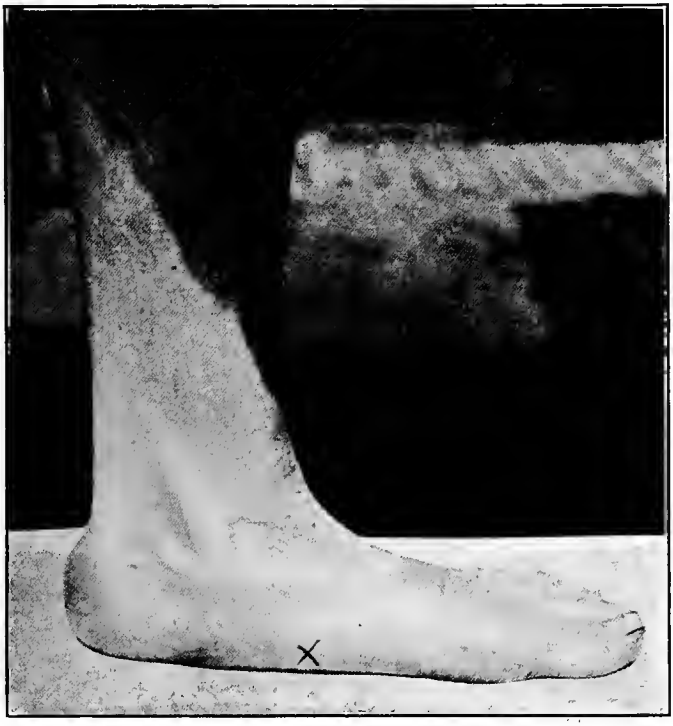


FIG. 18.—Medial view of abnormal foot. (Pes planus or flat foot.) Note at *x* the depression of the longitudinal arch.

cap, middle of the leg, and to the center of the longitudinal arch. When the toes are turned out this line of weight bearing is shifted inward on the inner portion of the longitudinal arch which may or may not be able to bear the burden. If not,

FIG. 19.—Posterior view of feet practically normal. Left ankle shows slight inversion (turning in). Right ankle normal.

the inevitable happens—the muscles fail to buttress the bony arch and the latter fails with stretching of the ligamentous attachments.

Objectively, in cases of Pes Planus inversion (turning in)

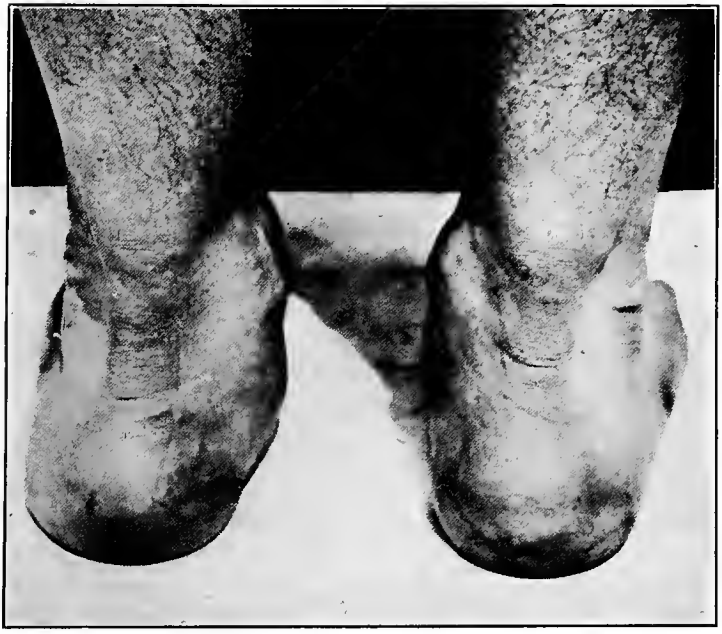


FIG. 20.—Posterior view of abnormal feet. Note the inversion (turning in) of the ankles. A case of pes planus (flat-foot).

of the ankles may be noticed. However, this may be absent or even occur in the opposite condition Pes Cavus or Hollow Foot. This inversion of the ankles should not be taken as a criterion in diagnosing the condition of Flat-foot. The arches' appearance as the bare feet with the full weight upon

them are placed in a plane surface offer no means of discovering the true height of the bony arch.

The symptoms of flat-foot are varied and numerous. However, the predominant one is pain in the feet. This may be located indefinitely in the arches of the feet, heels or secondarily in the calves of the legs, knees or hips. The pain is usually absent during rest and is experienced only when use of the feet is attempted.

Treatment.

1. Complete rest for a few days.
2. Alternately immersing the feet in hot and cold water.
3. Correct walking posture; the feet parallel in standing and walking.
4. Feet measured and shoes fitted.
5. Foot exercises.
6. Strapping of the feet which should be done or supervised by the Medical Officer.
7. Shoe alterations to shift the misplaced weight where it naturally belongs.
8. Arch supports should not be worn for this condition as they tend to decrease the muscular power of the soles of the feet.

PES CAVUS

(Hollow-foot)

It is important that this condition, heretofore conspicuously absent from Foot Manuals in general, be discussed and brought to the attention of officers because of its extreme disabling character when made manifest. In the past the subject of Pes planus (Flat-foot) has, in my opinion, been stressed entirely too much both by manufacturers of foot supports for

pecuniary reasons and by military men because of carelessness or inadequate means of examination. By this I do not mean to say that Pes Planus (Flat-foot) is not common, it is common;

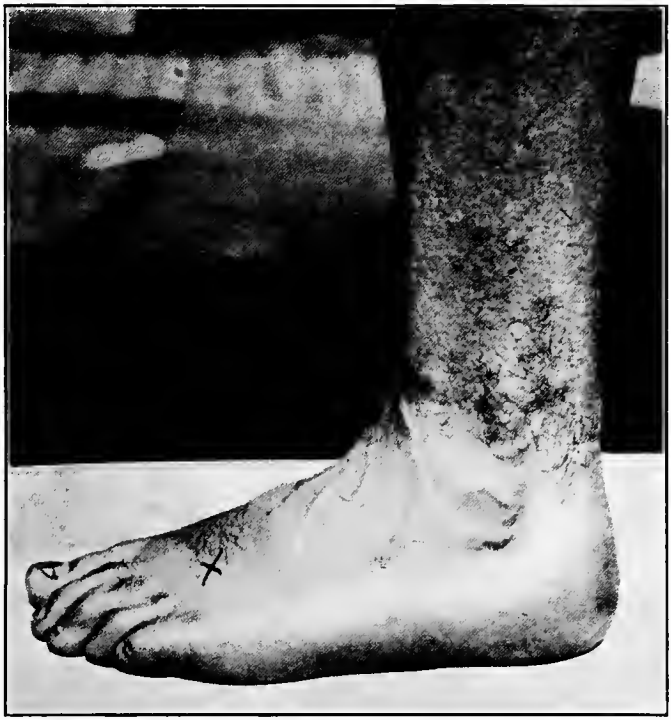


FIG. 21.—Lateral view of normal foot. Note convexity of area marked *x* denoting the integrity of the anterior arch.

but still other conditions exist and we should watch for them with an unbiased frame of mind. Pes Cavus (Hollow-foot), is just the opposite and is a condition where the longitudinal arch is higher than normal. It has been noted so frequently

in foot examinations where a previous diagnosis of flat-foot by inspection had been made, that it is hereby brought to the attention of officers as an entity.

This condition of Pes Cavus, more common than has been

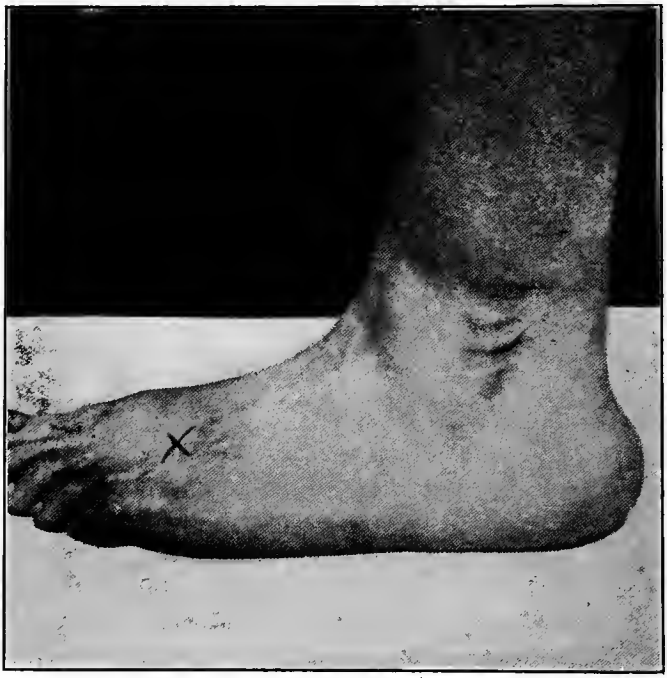


FIG. 22.—Lateral view of abnormal foot (flat-foot). Note at *x* the flattening denoting the fall of the anterior arch usually associated with pes cavus.

formerly thought, is characterized by a longitudinal arch higher than normal, poor muscular development of the soles of the feet and an inherent tendency on the part of the individual to shift the greater part of the weight to the outer

borders and balls of the feet. Where the arch has assumed a great height and the muscular development is poor the weight is not borne by the outer borders of the feet but is in turn shifted entirely to the balls of the feet (anterior arches). These latter, being unable to support the weight, fall. Associated with extreme degrees of Pes Cavus and fallen anterior arches is the condition of inversion (prominence of inner side of the ankle). For facility of description and measurement for treatment Pes Cavus has been divided into three degrees of height; one, two and three. (See foot imprints.)

The causes of Pes Cavus are usually ill-fitting shoes which, cramping and binding, restrict functional activity. The assumption of great burden and excessive hiking also play a part in making a condition worse the tendency of which has existed since birth due to inherent organic and functional muscular deficiencies. Again, incorrect foot posture with the toes turned in has a part in the causation of the condition. The most common causes from ill-fitting shoes are:

1. Shoes too short.
2. Shoes too narrow across the instep and ball of the foot.
3. Heels of shoes too high with (1) and (2).
4. Pointed-toe shoes (English) where the inner side of the sole curves outward.
5. Poor muscular development since birth with incorrect foot posture.

The symptoms are very fugacious and inconstant. Many complain of pain, which at times becomes intense when weight is borne, situated in the toes, ball of the foot and longitudinal arch. The pain does not tend to remain at one point but skips from place to place.

Treatment: Where the soldier is disabled and incapacitated and this condition is suspected, temporary relief may be obtained by placing a gauze or felt pad ¼ inch in thickness under

the longitudinal arch and strapping it in place with adhesive tape. The thickness of the pad may be increased or decreased until relief is experienced. Alternately immersing the feet in hot and cold water-contrast baths—gives comfort. Where circumstances permit, however, all cases should be sent to the Medical Officer for diagnosis and treatment.

PEDOGRAPHS (FOOT IMPRINTS)

The method of diagnosing foot affections by a casual inspection, walking or hopping test, or by palpating the foot has been discarded as obsolete and inefficient.

By the pedograph method five prominent signs are taken into consideration. These signs are:

1. The pedograph picture;
2. The contour line of the foot;
3. The height of the scaphoid bone (the keystone of the longitudinal arch);
4. The muscular development of the soles of the feet, especially under the longitudinal arch;
5. The presences or absence of the juvenile fat pad.

In taking the imprints the individual is seated and extending the leg the bare foot is painted with an iron solution.

Formula of Iron Solution.

Tr. Ferric chloride	45 c.c.
Glycerine	5 c.c.
Alcohol	50 c.c.

Then hastily, the foot is placed on paper, porous in character, and the individual is told to place all the weight on the one foot. At this point the contour line is drawn by using a pencil held at right angles to the plane surface. This contour line demonstrates the amount of inversion of the ankle although

the muscular development of the soles of the feet should be watched as often a heavy bulging muscular layer will produce the picture of inversion. The foot is then removed from the paper and the height of the scaphoid bone estimated. This is done by drawing a line from the posterior-inferior aspect of the inner malleolus to the first metatarsophalangeal joint on its plantar aspect. The scaphoid bone is usually felt one-half inch below this line which is known as the Feiss Line. The sole of the foot is then palpated and the muscular development noted as thin, moderate or thick. Presence of the fat pad is also sought for. All this cumulative data is then marked on the pedographic sheet together with the man's name, rank, organization, and diagnosis.

A solution of tannic acid is now applied to the iron imprint of the foot which turns a jet black. The formula of the tannic acid solution is:—

Tannic acid..... .....gm. x (by wt.)
Alcohol.. ... ... .90 c.c.

The base lines and auxiliary lines are now drawn on the pedograph for estimation of the disability if present.

The first base line is drawn from a point posterior to the internal malleolus to the first metatarsophalangeal joint. The contour line extending beyond this shows the degree of inversion. The line of axis weight bearing is next drawn from the center of the heel to a point midway between the first and second toes. A line *O* is next drawn at right angles to the line of axis weight bearing from a point posterior to the heel. A line *M* is next drawn also at right angles to the line, of axis weight bearing, from the first metatarsophalangeal joint. Midway between the line *M* and *O* is drawn the line of estimation, also at right angles to the line of axis weight bearing. The line of estimation is then checked. One check is placed

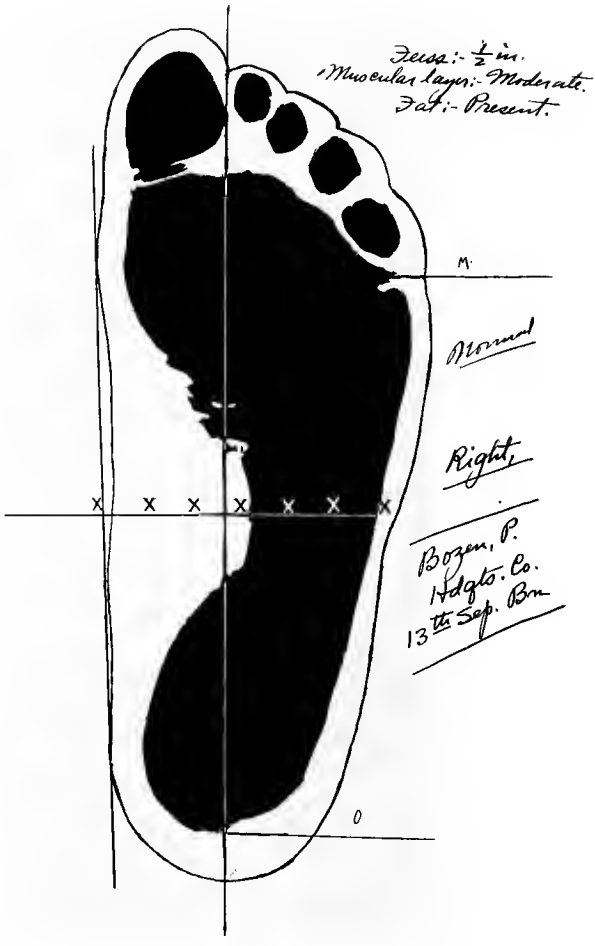
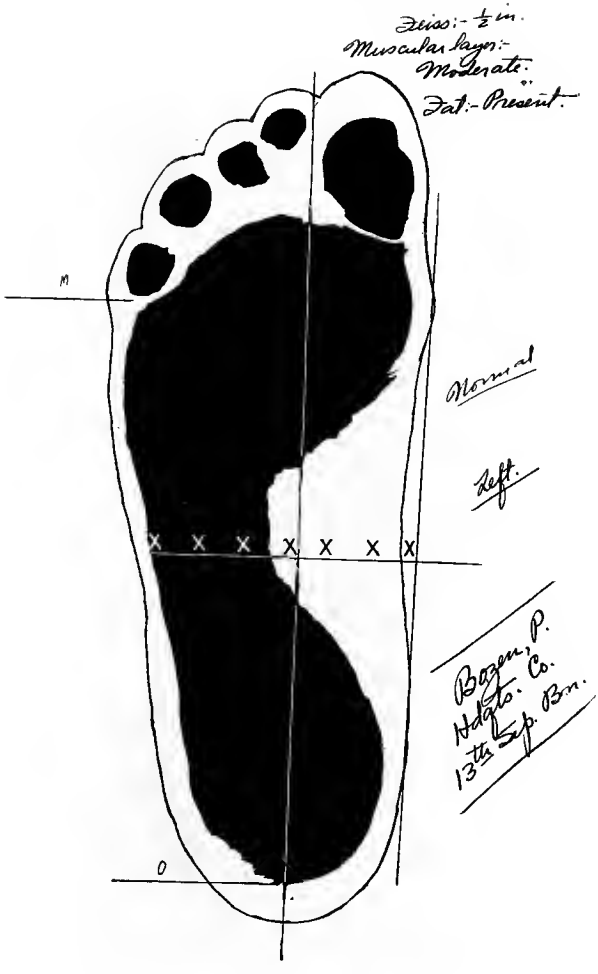


FIG. 23.—Pedograph. Normal foot.



FIG, 23*a*.—Pedograph. Normal foot.

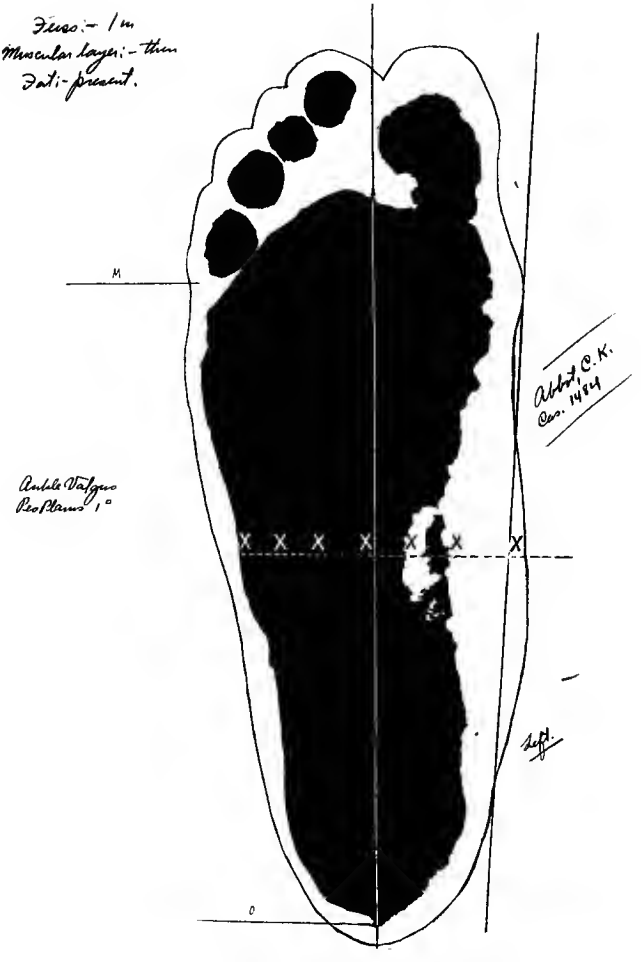


FIG. 24.—Pedograph. Pes planus (flat-foot). 1°.

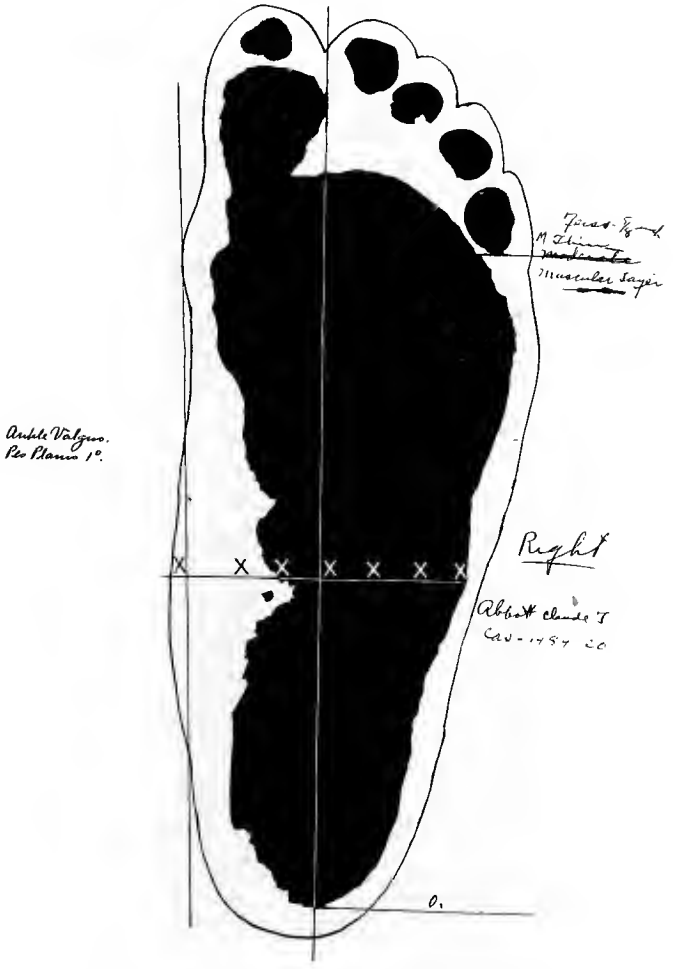


FIG. 24*a*.—Pedograph. Pes planus (flat-foot). 1°.

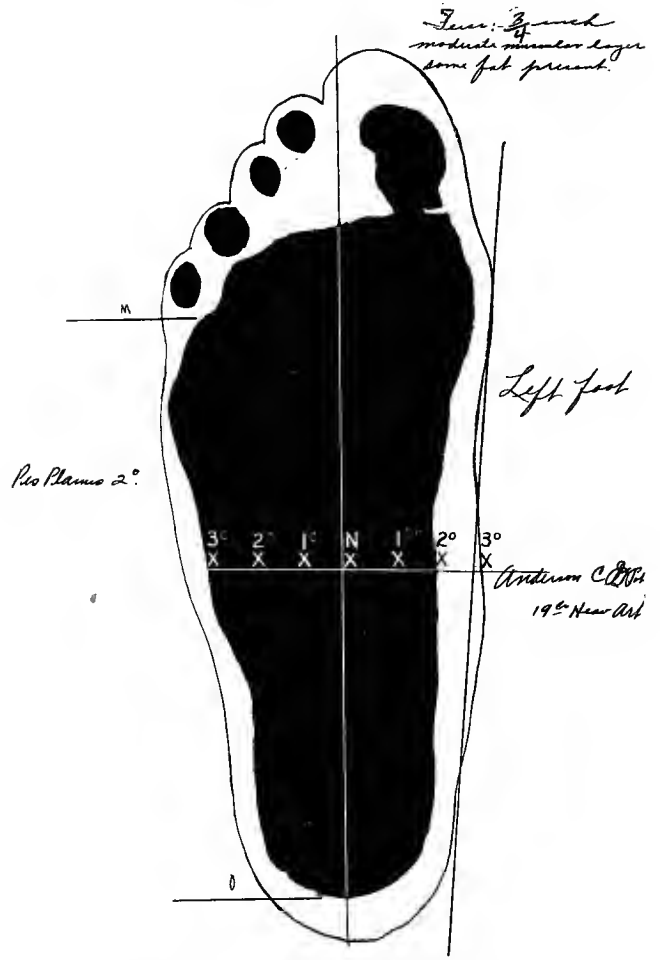


FIG. 25.—Pedograph. Pes planus (flat-foot). 2°.

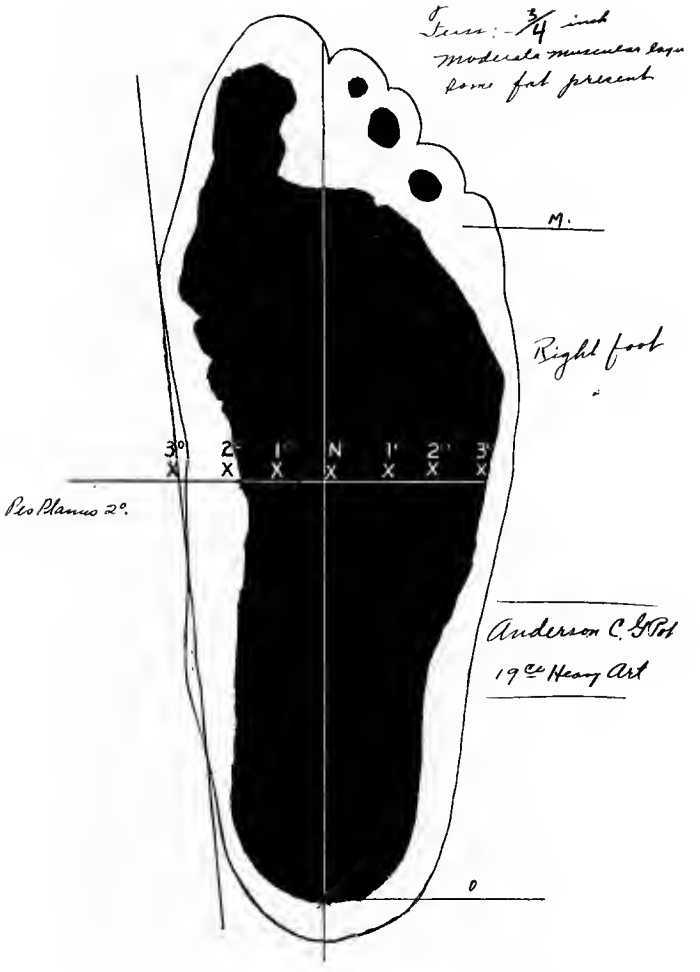


FIG. 25*a*.—Pedograph. Pes planus (flat-foot). 2°.

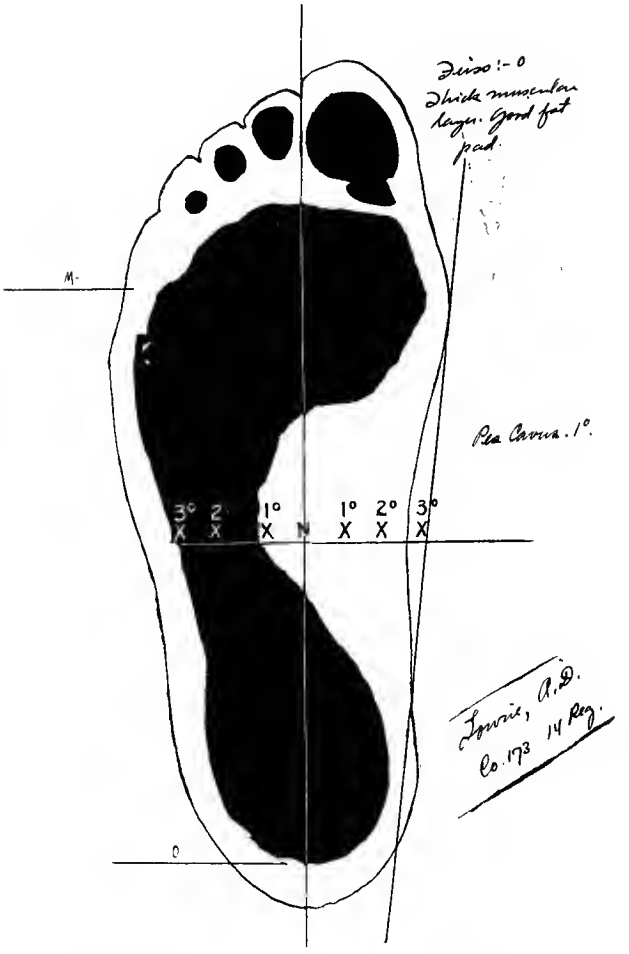


FIG. 26.—Pedograph. Pes cavus (hollow foot). 1°

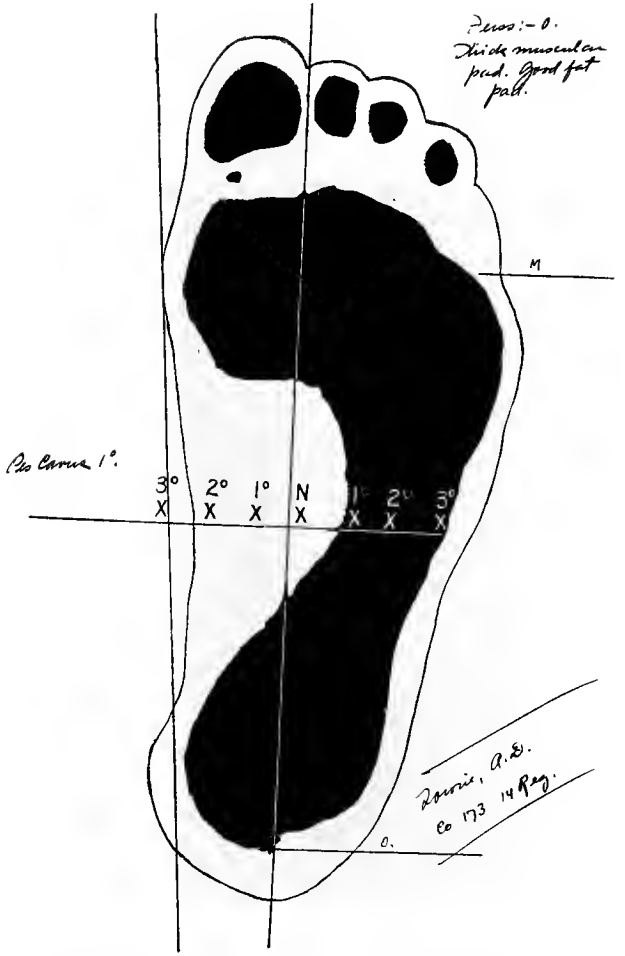


FIG. 26*a*.—Pedograph. Pes cavus (hollow foot). 1°.

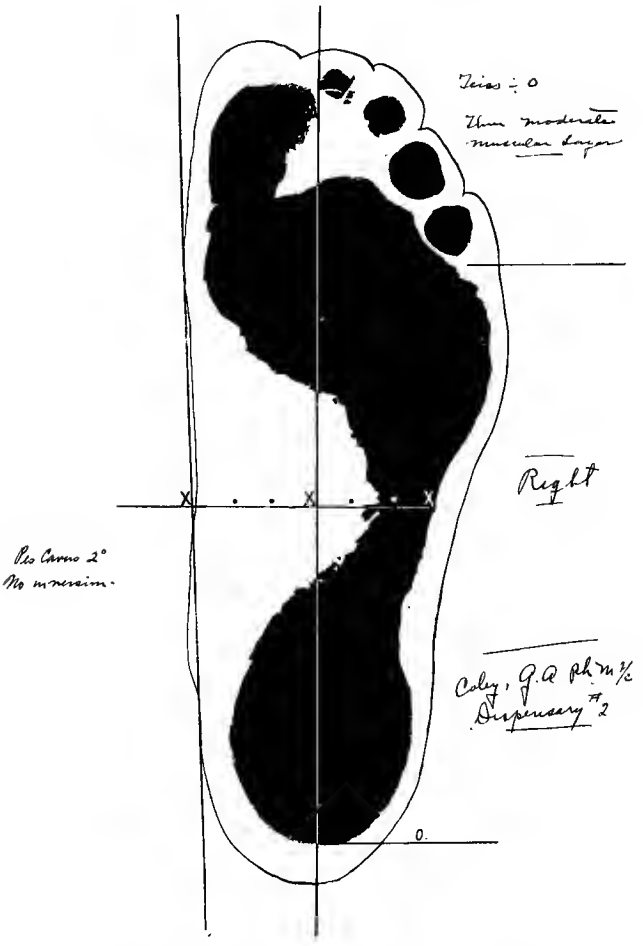


FIG. 27.—Pedograph. Pes cavus (hollow foot). 2°.

FIG. 27*a*.—Pedograph. Pes cavus (hollow foot). 1°.

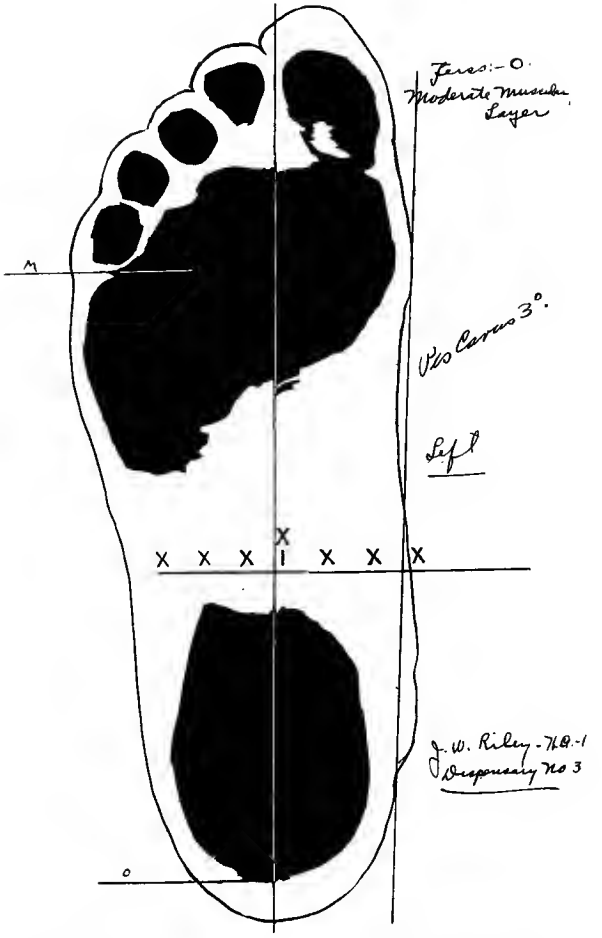


FIG. 28.—Pedograph. Pes cavus (hollow foot). 3°.

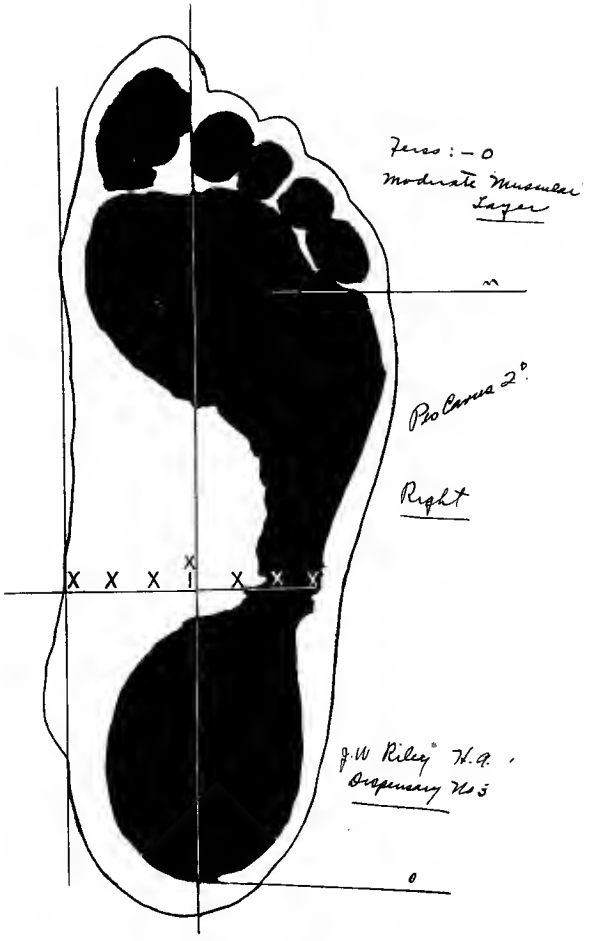


FIG. 28*a*.—Pedograph. Pes cavus (hollow foot). 2°.

at the outer border of the imprint, the other check being placed at the junction of the line of estimation and the first base line, or if valgus exists, at the junction of the line of estimation and the contour line. Midway between the two check marks of the line of estimation is the point *N* which is normal. To the inner side of point *N* the line is divided into three parts representing the degrees of Pes Planus, while to the outer side of the point *N* the line is divided into three parts representing the degrees of Pes Cavus.

The above method, with the exception of some modifications, was originated and used by Dr. Edward A. Rice of Washington, D. C.

SHOE-FITTING

Comparison of Marine Corps and Civilian Lasts

The average individual, upon being measured and subsequently fitted, almost invariably asserts that the shoe given him is too large and that in civilian life he wore such and such a size shoe without suffering any inconvenience. From this he deducts that he is the most competent judge of his own size. Furthermore, he declares that he can never wear the size fitted him and predicts with all earnestness the direst calamity that will befall him on the future march or drill. This man is a fair sample of those who, ignorant of their own size and of the difference in sizes between the Marine Corps Lasts and Civilian Lasts, endeavor to jam their feet into anything made of leather because of the prevailing style. This is a result of the haphazard pernicious system of demand for appearance which has ruined more feet than can be estimated.

In this discussion many details of difference between the sizes of the Marine Corps and Civilian shoes could be enumerated. However, details are dry and uninteresting; and it is

the purpose of this Manual to eliminate such superfluous material where possible. Suffice it to say that a Marine Corps shoe size 7EE is far different from the corresponding

FIG. 29.—Anterior view of marine corps garrison or dress shoe.

civilian shoe size; and further that civilian shoes made by different manufacturers differ among themselves. These differences of size may be one of length or width. It is therefore self apparent that, as the military shoe is a shoe distinc-

tive and physiologic, every man should be correctly measured and fitted when he first enters the service if he is to be efficient and render full value to the government.

The great majority of recruits received in the service for training are men who were formerly occupied in sedentary occupations; exercising but little or none at all and riding

FIG. 30.—Lateral view of marine corps garrison or dress shoe.

whenever possible on street cars, automobiles, bicycles and the like. This universal aversion to walking is not at all startling and exceptional but typical of the man of today who surrounded by mechanical conveyances of all types, saves himself the effort and takes the path of least resistance. This type of man will usually have undeveloped relatively weak feet. Now supply this individual with shoes the sizes of which have been selected haphazardly and he will stand

an excellent chance of having feet which are ruined organically and functionally before he leaves the training camp or is sent back from the firing line.

Then there is that other type of individual who has practically earned his livelihood by constant use of the feet. This individual usually has well formed, well developed, strong feet. These feet one would call "good feet." Literally, throw shoes at this man, or allow him to select his shoes from

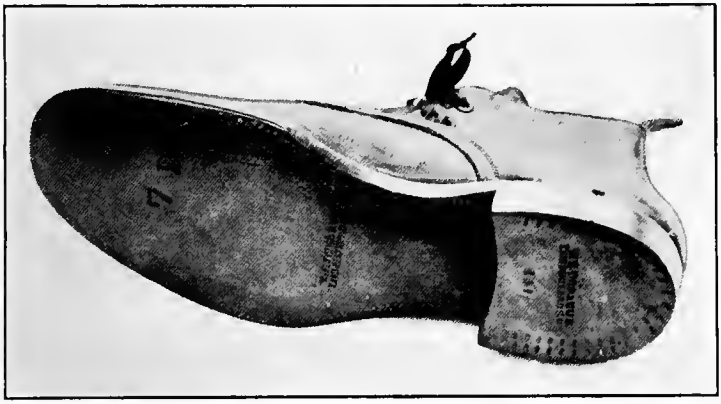


FIG. 31.—Sole of marine corps garrison or dress shoe.

the pile, and those *good feet* will not last long under the stress and strain of military life. It requires no mental effort to readily perceive that no matter whether a man enters the service with well or badly developed feet the end result is always the same if care is not taken to measure his feet and fit shoes correctly.

Causes of Misfits.

In the past when large numbers of men arrived suddenly at a concentration or training camp and immediate outfitting was

imperative, commissary officers and their assistants often allowed the recruit to specify the size shoe he wore and in some instances permitted him to select his shoes from a pile. Such an unsystematic procedure necessarily resulted in a large number of men receiving ill-fitting shoes with subsequent foot disability. Fortunately for the efficiency of our armed forces such an antiquated, obsolete measure has been discarded.

Consideration of the Ball Points in Fitting.

Where the first metatarsal and fifth metatarsal bones join the higher and larger bones of the ankle proper or instep there are located points called the "ball-points." These

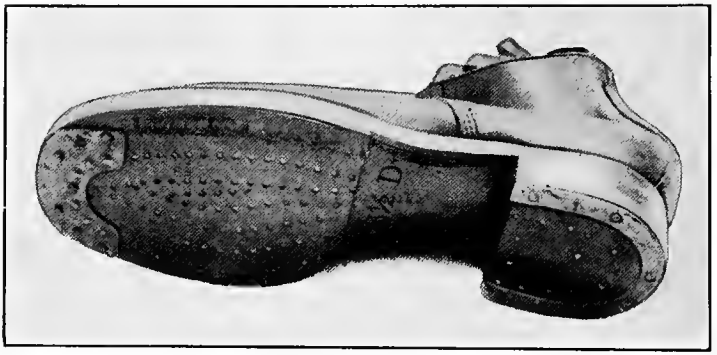


FIG. 32.

points for the sake of convenience in description and according to size may be designated as the primary and secondary "ball-points." The primary or large "ball-point" is located on the inner side of the foot back of the big toe where a prominent protruding eminence is seen. The secondary or small "ball-point" is located on the outer side of the foot back of the little toe where a protruding but less prominent point is

noted. In locomotion when a step is taken, and the heel raised it must be understood that both these joints move simultaneously.

In fitting a well-constructed military shoe it must be made certain that these two points correspond with the "break" or the "ball-points" of the shoe sole and shoe upper in flexion of the foot. When ill-fitting has occurred these points may be anterior or posterior to the "break" with evil results. Also where the "ball-points" of the feet and shoes fail to coincide exactly there is a loss of gripping or propelling power directed backward to shove the weight borne forward.

SHOE-FITTING

Consideration of the Variation Between the Left and Right Foot

The difference in the general characteristics of individual men's feet and between different individuals is strikingly apparent when measuring and fitting is practised. The points of difference are not merely width and length but involve multiple minor parts which together form a proposition of which some cognizance should always be taken. In discussing the similarity of people's features we always say there is "something" about him or her that is familiar but cannot definitely say. We cannot definitely say because our casual inspection is not complete enough. Correspondingly there is that "something" about the feet which collectively make a great difference and presents obstacles which must be overcome if accurate measuring and fitting is to be practised. These differences between the feet may be stated to consist essentially in the posture of the feet causing the ankle joint to be deviated inwards or outwards; the slope of the toes backwards from the great toe presenting, according to the

Lateral view.

Anterior view.

FIG. 33.—Newly designed dress shoe U. S. Marine Corps.

length of the toes either a pointed or square front; one may be thin, bony and devoid of extensive muscular development while the other may be fat, well padded in the heel, sole and around the joints and very much thicker through any given part than the other. Again the heights of the arches both anterior and longitudinal differ; and there may be a great difference in the distance from the back of the heel bone to the metatarsals in one individual's feet and the distance between the same points in another's. The distance mentioned—from the back of the heel bone to the metatarsals—is of great importance in fitting as it fixes the location of the primary and secondary ball-points.

In investigations conducted in the Army Concentration Camps it was found that in 60 per cent. of the enlisted men's feet the left foot was larger than the right. In some cases this difference equalled two full sizes. Such findings as this suggest food for thought. However, even with this great variation in some cases there will not result any mistakes in fitting either foot too short, as the Resco Marine Corps Fitting System requires that each foot shall be measured and the larger foot serve as the index of size.

The correctly fitted shoe must allow all parts of the foot to function unrestricted and unhampered by any impediments. The parts of the foot which are important to consider in regard to the degree of functionability when a shoe is fitted are the following:

1. The anterior and longitudinal arches.
2. Expansion of the foot sidewise and lengthwise.
3. The "Tripod"—the principal points of locomotion and weight bearing—must be considered and shoes fitted so that it is allowed to spread apart and afford the maximum bearing surface. (See Anatomy and Physiology of the Foot.)

SHOE-FITTING

When the present system was introduced abundant opportunity was offered to study the psychology of the individual in regard to the shoe question. Upon a careful investigation at this camp (Quantico, Va.), concurring with similar investigations at different camps throughout the country the following characteristic points of the recruit were noted:

1. An inherent reluctance of the recruit to coöperate and to accept "something that was new" as conclusive evidence.
2. Personal vanity played a great part. Feet were often jammed in shoes one to one and a half sizes too small for them.
3. Absolute ignorance of his own shoe size.
4. Ignorance of the fact that fitting must be practised with the point in view that the feet expand due to burdens borne and subsequent development from training.
5. Ignorance of the difference between the Marine Corps (Military) Last and the Civilian Last.
6. Ignorance of the corresponding sock size.

The system as used at present is not infallible. The detail of men engaged in the work must be previously trained; show an esprit of coöperation; care for and note constantly the condition of the machine; work with speed but not unnecessary haste; work accurately and demonstrate good judgment.

In measuring the feet and fitting large members of men the following deviations of shoes from the accepted standard were noted:

1. Shoes too short.
2. Shoes too narrow.

Although shoes were sometimes found too large either in width or length this class was decidedly in the minority.

SHOE-FITTING

Resco Marine Corps Shoe-fitting System

The two devices used in this shoe-fitting system count for simplicity of operation and facility in measuring and fitting large numbers of men in the least possible amount of time. One device—the foot measuring machine—follows roughly the

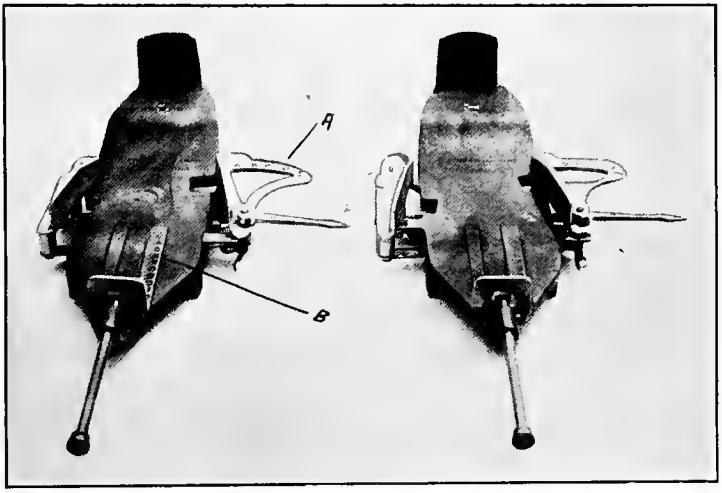


FIG. 34.—Resco marine corps foot measuring device.

contour line of the bottom of the adult human foot but is larger. This machine is of cast metal and has the heel position elevated to a correct height for positioning the human heel when the foot is being measured for the Marine Corps Shoe. A composite of the angles of the inner-soles and lasts of all Marine Corps sizes in the Marine Corps size range determines the angle at which the side wings are set. The operation and adjustment of the small pointer on the width scale moved by

the spreading side wings has been thoroughly worked out. This machine essentially translates the foot length and width into the shoe size length and width.

The second device—the shoe-fitting device—consists of a set of thin metal blades each possessing a metal knob one-half inch thick on one end. The lengths of these blades respect-

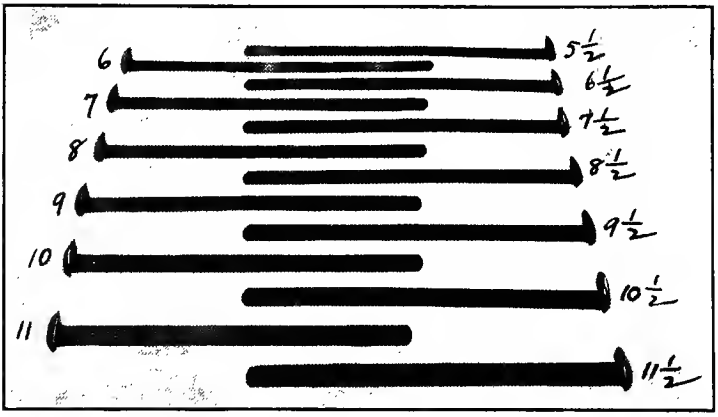


FIG. 35.—Resco marine corps shoe fitting devices. Sizes corresponding to shoe lengths indicated.

ively corresponds with a shoe length which they verify after the foot has been measured in the foot measuring machine.

A study of the illustrations accompanying this section will readily make clear the construction and operation of these devices.

Although the great majority of shoe wearing people have not normal feet according to the classic standard certain reservations are made and this measuring machine is constructed for the great average of supposedly normal feet according to the standards of to-day.

In attempting to measure markedly abnormal feet accuracy is sacrificed. For every established last there is a type of machine, *e.g.*, the Marine Corps, Navy and Army.

PROCEDURE IN MEASURING THE FOOT

The individual removes his old shoes, puts on his Marine Corps Pack, holds his rifle and mounting the measuring platform sets his stockinged foot onto the base of the machine making certain that the heel fits snugly against the curved block at the back. At this time the measurer notes carefully whether the center of the foot is in the center of the machine. To do this he imagines a line through the center of the foot from the heel to the toe and makes this line correspond with a like line in the bottom of the machine.

The wings at the sides are then released and permitted to press tightly against the sides of the foot. The plunger on the front of the machine is then pressed backwards until it touches the end of the foot. Thus the width and length indicators are set. However, this is not final.

The person being measured is then requested to balance on the foot being measured by resting the hand against an overhead support and told to raise the heel one-fourth to half an inch placing all the superimposed weight on the ball of the the foot. This rising simulates locomotion; and since he is bearing all the weight he usually bears on the march the act will cause the same expansion of the foot length and sidewise.

Upon this act of rising there is a resultant spread of the foot; a pushing of the plunger forward; and he wings laterally indicating automatically the correct shoe length and width.

The indication of the shoe length is always positive. This is not so, however, with the shoe width. As the person raises the heel up and down the width indicator will sometimes be

seen to waver back and forth. The measurer noting this takes the middle mark between the extensive points touched by the width indicator as the correct width.

For instance if the pointer vacillates between width E and width F the correct width for the shoes would be a width EE. Wherever doubt is entertained as to the exact points of width

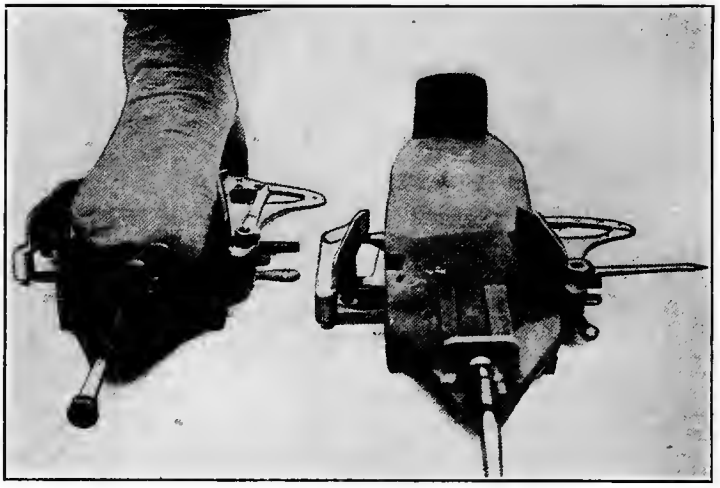


FIG. 36.—Foot being measured in Resco marine corps foot measuring device.

and length is always best to select the greater length and narrow width. So simple is the indication of the size that the interpretation is made quickly and accurately which counts for efficiency in measuring.

In the U. S. Army Special Regulations No. 28 complete instructions for using the machine are given. They are as follows:

(*a*) After taking the machine from its box, open it widely by moving the lever as far front as possible and pulling out

the plunger as far as it will go. The machine is now ready for use.

(*b*) Have the man put his foot in the machine and stand with all his weight. The heel should rest firmly against the heel block. It is important that the foot should rest in the exact center of the machine.

(*c*) Release the lever which operates the width indicator, and push the plunger until the plate touches the toe. Do not touch the plunger again while the foot is in the machine. Make sure that the metal side pieces touch the toe joints.

(*d*) Then let the man throw his entire weight on the ball of his foot, raising the heel slightly.

(*e*) The width is automatically registered by the arrow as the arrow wavers, following the action of the heel up and down, take the average of the extremes.

(*Example*. If the arrow wavers from width "*b*" use width "*c*.") The correct size of the shoe is indicated by the pointer on the plunger on the right-hand scale.

(*f*) Measure the other foot in the same manner and if there should be a difference select size to fit the longer foot and the narrower width.

(*g*) Oil the slide under the device occasionally.

NOTE.—Verify the length selected by testing with shoe-fitting device.

SHOE-FITTING

Verifying the Size and Fitting the Shoe

In this final and most important act the fitting device is used to verify the size of shoe *length* as indicated by the foot measuring machine. Width is determined from the measurements of the measuring machine and is not demonstrated by the fitting device.

FIG. 37.—Resco marine corps shoe fitting device in position (shoe fully laced) demonstrating the correct amount of space which should exist between the end of the big toe and the knob of the device.

The shoe-fitting devices, as previously described, are thin metal blades each one of which possesses a metal knob on one end; and corresponding to a shoe length, is so marked, for example, 7, 7½, 8 and so on.

The device, corresponding to the shoe length as measured, is inserted into the shoe cavity; the knob end slipping into the toe cavity and pressing against the leather of the end of the shoe, while the other end of the device presses against the heel. The blade of the device being flexible readily conforms to the curvature of the arch and lies flat and snugly on top of the insole.

Both shoes being thus treated, they are laced firmly and snugly; and walking is done back and forth on a level surface, up a flight of staris to a level platform and down a elevated incline. This walking and stamping on plantigrade surfaces simulates the conditions of marching and serves as an index of the foot expansion in the service shoe bearing the superimposed weight of the body and equipment. The foot thus being made to expand sidewise and lengthwise to its maximum a very clear idea is obtained of the shoe fit.

The person being measured should be able to thus walk without the toes jamming against the knob to such an extent that discomfort and pain is experienced if the measurer has been accurate in his estimations. Merely touching the device is not considered. Actual discomfort must be produced before the size of shoe is changed. From this it can be readily seen and appreciated that where discomfort is not produced by the toes jamming there is sufficient space allowed for toe action when the blade and knob are removed. Such is the purpose of the device.

It has been found that coöperation of the person is essential and during the process of "trying out" the shoe by walking, standard questions are asked by the fitter who bears in mind

FIG. 38.—Resco marine corps shoe fitting device and foot in the shoe cavity. (*X*-ray photograph.)

the important parts of the shoe which must fit correctly. Such questions are: "Do your toes touch the knob?" "If so is discomfort or pain experienced?" "Does your foot slide forward in the shoe?" "Is the upper too loose?" "How does the shoe feel across the toes and instep?" This, in addition to the mechanical devices, is conducive to accurate and conclusive results as found by extensive practice on this station. (Quantico, Va.)

If the length is correct, which it shall be if the procedure described is carried out, there shall not only be comfort but also the ball-points of the foot will be exactly opposite the ball-points of the shoe and thus the two will move synchronously in locomotion.

The correct use of the shoe-fitting device has practically eliminated the old fault of short shoe sizes. However, mistakes may be made if judgment is not practised. Especially so, where the length is correct, but the heel of the foot abnormally narrow and therefore not gripped by the shoe, the foot slides forward in the shoe and presses against the knob. This condition will also happen if the shoe is too wide.

Width if not accurately determined by the measuring machine must be done by hand. The person faces the fitter who grasps the leather back of the toe cap with the index-finger and thumb. A faint movement of the leather should be detected by the gripping fingers if the width size is correct. Where a distinct ridge of leather is picked up, the inference is that the width is too large, and conversely, if no movement of the leather is detected the width is too small. In estimating width much depends on the training of the fitter and his judgment. However, in addition to the above, the comfort of *the individual* is considered and the question is asked whether the toes are pressed upon tightly or the shoe is too loose over this particular part.

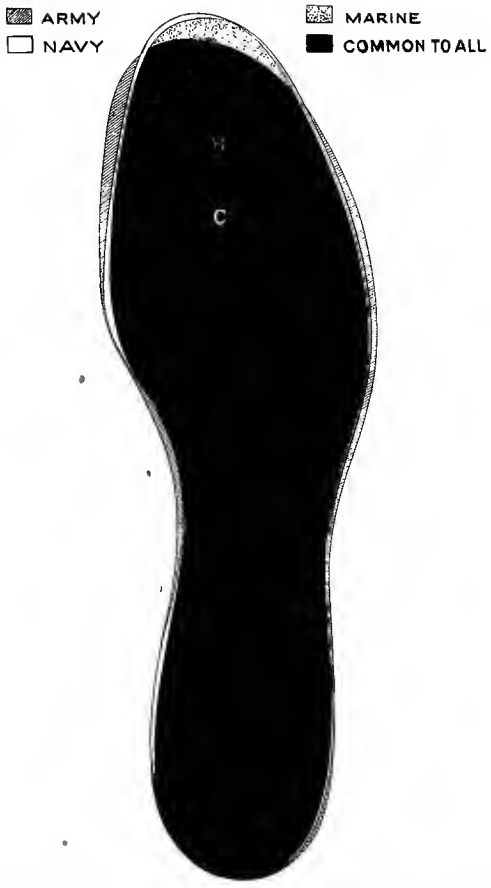


FIG. 39.—Outline of sole of composite last suggested by Mr. E. J. Bliss, Boston, Mass.

The Army Special Regulation No. 28 on the use of the shoe-fitting devices are as follows:

(*a*) Select from the several measuring devices in the set the one marked with the size or half-size corresponding with the shoes to be tried on.

(*b*) Insert the knob end of the device into the toe of the shoe, springing the other end of device down to the inner sole, against the counter.

(*c*) The middle of the flat spring piece will lie flat with slight pressure of the foot.

(*d*) If the soldier, with pack and rifle on his back, can *without discomfort* pace back and forth in shoes with device inserted, the shoes will be sufficiently long to allow—for foot-expansion when the device is withdrawn.

NOTE.—The majority in every case pass satisfactory the above described test.

SHOE-FITTING

Measuring and Fitting Men at the Barracks (3000 Men and Over.)

(*a*) **The Fitting Quarters.**

The fitting quarters should be centrally situated or as near so as convenient in order that the least possible time will be taken by the men in passing to and from the building. The size of building recommended, and used with perfect satisfaction at this Post (Quantico, Va.) is the ordinary type of barrack building ninety-eight feet in length and nineten feet and four-sixteenths of an inch in width. This building is divided into three rooms, the waiting, measuring and fitting rooms, by partitions seven feet and four-sixteenths of an inch in height fitted with doors. These partitions extend width-wise at right angles to the long axis of the building. There is

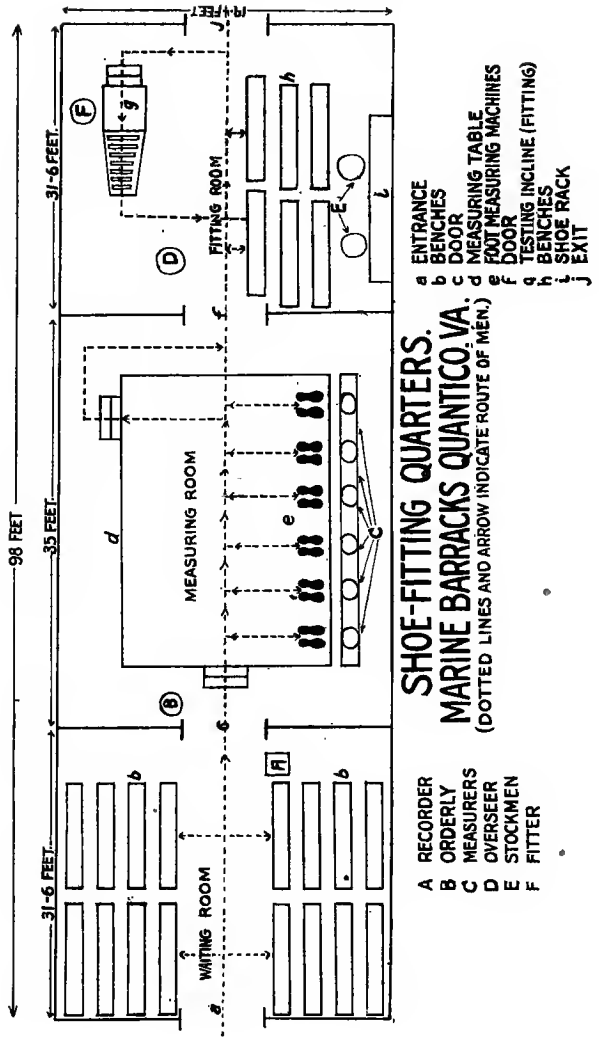

98 FEET
35 FEET
31-6 FEET.
31-6 FEET.
19 FEET
WAITING ROOM
MEASURING ROOM
FITTING ROOM
SHOE-FITTING QUARTERS.
MARINE BARRACKS QUANTICO, VA.
(DOTTED LINES AND ARROW INDICATE ROUTE OF MEN.)
A RECORDER
B ORDERLY
C MEASURERS
D OVERSEER
E STOCKMEN
F FITTER
a ENTRANCE
b BENCHES
c DOOR
d MEASURING TABLE
e FOOT MEASURING MACHINES
f DOOR
g TESTING INCLINE (FITTING)
h BENCHES
i SHOE RACK
j EXIT

FIG. 40.

thus provided three rooms of ample size through which men pass in a continuous stream; entering at one end of the building and passing out at the other. (See drawing.)

The waiting room at one end of the building is thirty-one feet and six-sixteenths of an inch long. It is fitted with as many ordinary mess benches as it will accommodate plus the recorder's table at the door leading into the measuring room. The table has legs thirty inches high and a top thirty-two inches by thirty-two inches. (See drawing.)

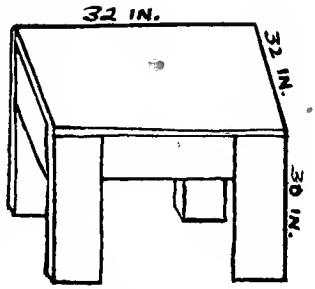


FIG. 41.—Recorder's table.

The measuring room at the center of the building is thirty-five feet in length and is fitted with the measuring table which is thirty inches high and possesses a top twenty-one by ten

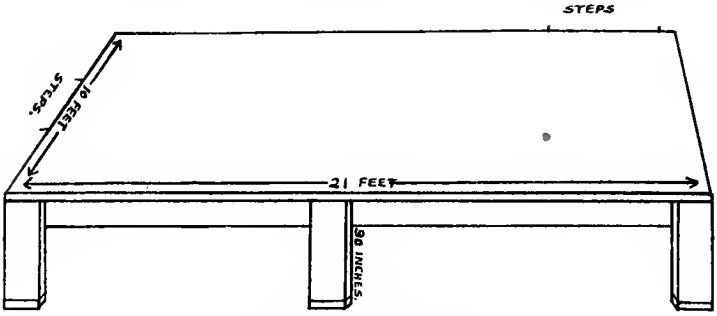


FIG. 42.—Measuring platform.

feet. (See drawing.) On one end and a side are steps to the floor. On this table are set the Resco Marine Corps Foot Measuring Machines six in number. Mess benches are provided for the measurers. (See drawing.)

The fitting room at the other end of the building is fitted with a shoe rack on one side, mess benches, and a testing incline on the other side. The shoe rack contains one hundred and forty-four pigeon holes and each pigeon hole is eight inches by six inches and is twelve inches deep. (See Fig. 45.) It is very necessary that one end of the rack be equipped with shelves of the same depth as the pigeon holes. Swinging doors, fastened securely with locks add to the security of the cabinet. Kept on hand in the rack at all times are one hundred and forty-five pairs of shoes; the sizes most common being emphasized. The sizes kept and the number of pairs of each size are as follows:

	Pair		Pair
5C	1	7EE	2
5E	1	7F	2
5EE	1	7½B	1
5F	1	7½C	4
5½C	2	7½D	2
5½EE	2	7½E	3
5½F	2	7½EE	2
6B	1	7½F	2
6C	2	8B	2
6D	1	8C	3
6E	3	8D	4
6EE	1	8E	3
6F	2	8EE	1
6½B	1	8F	1
6½C	3	8½B	1
6½D	3	8½C	3
6½E	1	8½D	3
6½EE	1	8½E	3
6½F	2	8½EE	1
7B	1	8½F	2
7C	3	9B	2
7D	2	9C	2
7E	4	9D	3

	Pair		Pair
9E	3	10½EE	2
9EE	3	10½F	1
9F	3	11B	1
9½B	1	11C	1
9½C	2	11D	1
9½D	3	11E	1
9½E	2	11EE	1
9½EE	2	11F	1
9½F	2	11½B	1
10B	1	11½C	1
10C	1	11½D	1
10D	3	11½E	1
10E	1	11½EE	1
10EE	2	11½F	1
10F	1	12B	1
10½B	1	12C	1
10½C	1	12D	1
10½D	1	12E	1
10½E	1		

The testing incline consists of a horizontal platform thirty-two by twenty-five inches equipped with legs thirty inches in height. The incline leading from one side of the platform

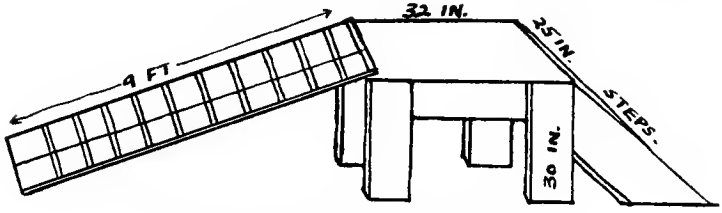


FIG. 43.—Fitting platform and test incline.

to the floor is nine feet in length with wooden cleats on its upper surface at intervals of three inches. On the opposite side of the platform are steps which are twenty-five inches from the table to the floor. (See drawing.)

SHOE-FITTING

General Procedure of Fitting

The company commander being responsible for the condition of the shoes and proper fitting of his command takes the initiative in arranging an engagement with the Medical Officer in charge of the measuring and fitting. Men who have just entered the service, those who have completed the training and those who are in need of new footwear are sent to the fitting quarters.

All the men upon arriving at the fitting quarters should have the pack and rifle, and be accompanied by the company commander or his representative. Entering the waiting room—the number determined by the recorder—everyone is ordered to remove the leggings and shoes. This done, men as needed are called by the orderly who stands at the door leading from the waiting room to the measuring room; and as each man passes the recorder a printed "Deformity and Recording Slip" is made out. The recorder writes the man's name, age, organization, date, time in service and record of present size of shoe. (See facsimile of slip.) The orderly closely observes the number of men in the measuring room and prevents overcrowding of the same by only calling a man from the waiting room when he sees one step from the measuring table to the fitting room.

Entering the measuring room the table is mounted by the person to be measured and the slip handed to the measurer. Deformities are noted and recorded if it is a first measurement; and each foot being accurately measured, as before described, the measurements as made are noted on the slip under the heading of "Estimated Size of Shoe." The slip is returned to the man and he passes on into the fitting room. Here again a check is maintained to prevent overcrowding in the

MEDICAL DEPARTMENT.
MARINE BARRACKS, QUANTICO, VA.

NAME F. R. Querson REG. F. D CO. @ PREV. SERVICE AOE DATE FITTED 4/27/19

DEFORMITIES OF FEET REMARKS	ESTIMATED SIZE OF SHOE	SIZE NOW WORN	FITTED SIZE	SIZE OF SOCK
Hallux Valgus			✓	✓
Valgus	RIGHT FOOT			
Hallux Rigidus				
Hammer Toe				
Clubbed Toes	6½ E	6 E	6½ EE	10½
Claw Toes				
Claw Foot				
Overriding Toes				
Ingrowing Nails				
Callosities	LEFT FOOT			
Bunions				
Pes Planus	6½ E	6 E	6½ EE	10½
Blisters				
Abrasions				
Painful Heel	FURTHER REMARKS:			
Painful Arches				
Metatarsalgia				
Tenosynovitis				

Signed E. A. Odlum
Lieut. M. C. U. S. N.

FIG. 44.—Facsimile of fitting slip as used at the marine barracks, Quantico, Va.

person of the shoe overseer who allows only the number of men to enter the fitting room equal to the number that passes out.

Entering the fitting room the slip is given to one of the stockmen who notes the "Estimated Size of Shoe" and procures from the rack a corresponding size of shoes containing in the shoe cavities the Resco Marine Corps Shoe Fitting Devices. The slip is returned to the man by the stockman.

The fitting platform is then mounted, and facing the fitter the slip is handed to the latter who notes the size supplied and examines the width of the shoe. The company officer stands beside the fitter to see that all his men are fitted satisfactorily. Walking is then practised on the testing incline to reveal any deficiencies in length. If the test is satisfactory and the size correct the fitter retains the slip and records the size as the "Fitted Size." "The Size of Sock" is recorded by reference to the Sock Scale. (See page 24.) The man is then told to remove the shoes, give them to one of the stockmen, place on his own and pass out by the shoe overseer who takes especial care that no fitted shoes leave the fitting room intentionally or otherwise.

The completed fitting slips are signed or stamped by the Medical Officer and sent to Company office where the "Fitted Size" and "Size of Sock" are entered in the man's record service book by the company clerk. (Marine Corps Orders; Number 42 (Series 1915) Dec. 20, 1915 Paragraph 185 (4)) Thereafter all shoes issued to the individual must correspond with the size entered in the record service book. The slips are returned by the company office to the Medical Officer in charge of measuring and fitting for his files.

Following this system at this Post working an enlisted personnel of eight men, an average of one hundred and twenty men an hour were accurately measured and fitted.

SHOE-FITTING

Measuring and Fitting Men at the Barracks or in the Field (500–3000 Men)

Fitting Quarters.

For measuring and fitting men totaling the above numbers half a barrack building the length of which is forty-nine feet or tents joined together so as to equal the amount of floor space included in the above will provide ample room for all purposes. It must be repeated again that a central location is imperative as the time element is very important. The division of the quarters into several rooms or of the tents into several compartments is not absolutely necessary just as long as the equipment is spaced correctly and the men engaged in the work are sufficiently acquainted with the routine to manage the men systematically as they pass through.

The equipment necessarily must be of such a size that it will be adaptable to the floor area without undue overcrowding and consequent confusion. Mess benches, if in the barracks, or logs and similar material, if in the field, will suffice as seats for those who remove the shoes and leggins. The recorder's table should be of the same size as described in Chapter 18, or in the field the top of a barrel, smooth top of a stump box, etc., can be utilized. A measuring table twenty by five feet equipped with legs thirty inches high is recommended; the plans to be the same as described for the larger table in Chapter 18 equipped with steps. In the field it has been found that an improvised bench, smooth topped large rock or stump with a sea box on top makes a fairly good fitting platform. (See illustration, Chapter 20). Testing incline and fitting platform should have same dimensions as mentioned in Chapter 18 for work in the barracks. In the field the testing incline can be made by placing two boards or logs in position, the proximal

ends resting on the sea box or its support and the distal ends on the ground. The rack required for fitting five hundred to three thousand men should contain approximately ninety-six pigeon holes, each pigeon hole being eight by six inches and twelve inches deep. Swinging doors fastened and held securely should be added. Shelves are optional depending on the amount of space. The sizes of shoes and numbers of individual pairs required would be approximately the following:

	Pair		Pair
5C	1	7½D	2
5E	1	7½E	2
5EE	1	7½EE	2
5F	1	7½F	2
5½C	2	8B	1
5½EE	2	8C	2
5½F	2	8D	2
6B	1	8E	2
6C	1	8EE	2
6D	1	8F	2
6E	1	8½B	1
6EE	1	8½C	3
6F	1	8½D	3
6½B	1	8½E	3
6½C	1	8½EE	1
6½D	1	8½F	2
6½E	1	9B	1
6½EE	1	9C	1
6½F	1	9D	2
7B	2	9E	2
7C	2	9EE	2
7D	2	9F	2
7E	2	9½B	1
7EE	2	9½C	1
7F	2	9½D	1
7½B	1	9½E	2
7½C	2	9½EE	2

	Pair		Pair
9½F	2	11C	1
10B	1	11D	1
10C	1	11E	1
10D	2	11EE	1
10E	1	11½B	1
10EE	2	11½C	1
10F	1	11½D	1
10½A	1	11½E	1
10½B	1	11½EE	1
10½D	1	11½F	1
10½E	1	12B	1
10½EE	2	12C	1
10½F	1	12D	1
11B	1	12E	1

Aboard ship the testing incline and measuring platform may be made by utilizing a mess bench with one pair of legs let down in the first instance and a mess bench and sea box in the latter. Other equipment as specified may be made and arranged according to the discretion of the Medical Officer.

Racks cannot be considered in the field. The best arrangement would be to procure the desired sizes and number of pairs of shoes from the Quartermaster; and placing a strip of adhesive plaster on the heel marking the size with ink arrange them in parallel rows on the ground according to size. The sizes and number of individual pairs will vary according to the number of men to be fitted. The list complied in this chapter is suitable for a starting point.

Fitting slips should be used in the Barracks and the same procedure carried out as described in Chapter 18. In the field it will be a rare occurrence if a man is measured and fitted for the first time so slips will not be so necessary. If required, however, slips of ordinary writing paper with measurements, etc., may be made out and sent to the company office for entry in the record service book.

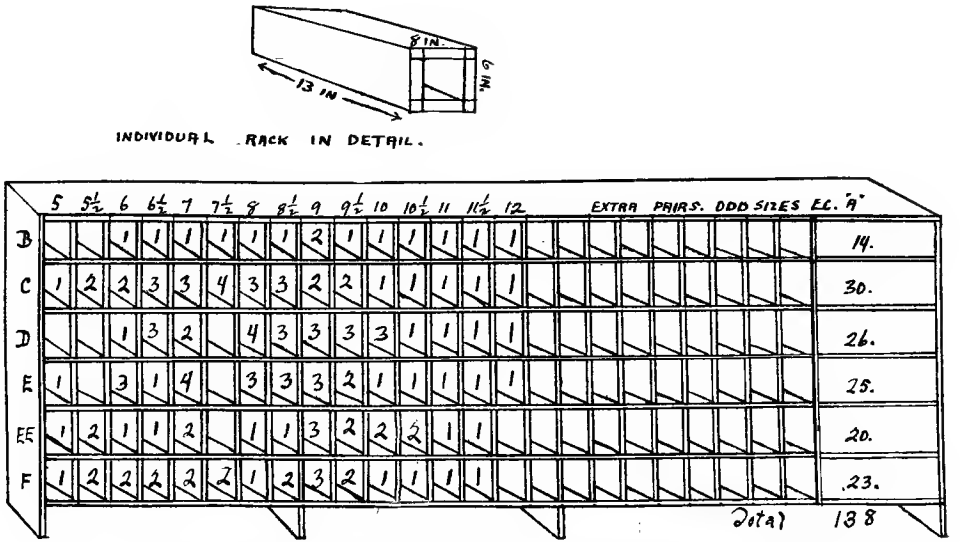


FIG. 45.—Shoe rack. 24 spaces long, 6 high. Arrangement of sizes of shoes and number of pairs of each size shown.

FIG. 46.—Foot in ordinary civilian or so-called English last. Note the lessened width and length restricting toe action. (*X*-ray photograph.)

FIG. 47.—Foot in marine corps last. Sufficient length but insufficient breadth. Toes, however, are deformed by wearing civilian lasts. Note the outward deviation of the big toe (hallus valgus). (*X*-ray photograph.)

The personnel will consist of:

1. The Recorder.
2. The Orderly.
3. Two Measurers.
4. The Shoe Overseer.
5. The Stockman.
6. The Fitter.

The duties of these men have been explained in Chapter 18 so repetition is unnecessary.

SHOE FITTING

Measuring and Fitting Men in the Field (500 Men or Less)

Measuring and fitting in the field will sometimes tax the ingenuity of the Medical Officer. However, it should not be difficult if he is thoroughly acquainted with the system as

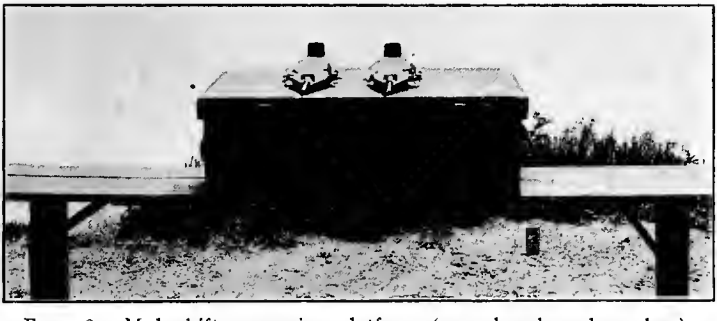


FIG. 48.—Makeshift measuring platform (mess bench and sea box).

used in the Barracks. Being thus familiar with the system generally, he can devise many make shift appliances, arrange his men correctly and do efficient work.

In the field the greatest number of fittings will be second or

FIG. 49.—Marine fully equipped on makeshift fitting platform. Medical officer is observing the fit.

third fittings, where the data for sizes will be taken from the record service book. It is evident, then, that the great bulk of the work will be devolved on the fitters and that the measurer will have little to do. It is therefore recommended that the fitting space, where comparative seclusion is essential, be placed under cover.

The general plan of the measuring and fitting spaces will be similar to those used in the Barracks. A space of ground two hundred and twenty-five square feet should be pegged off with wooden pegs. In this space may be placed logs,

FIG. 50.—Makeshift test incline and fitting platform for use in the field composed of a sea box, mess bench and two planks.

boxes and similar material for those who have to remove the shoes and socks. Here also will sit the recorder with a box upon which are placed the record service books of those who are to be measured for the first time. Regulation fitting slips or slips of writing paper may be used to record first measurements and fittings.

Directly in front of the waiting space is a space equal in area which is also pegged off; this is the measuring space. Here may be placed a makeshift measuring platform. (See illustration.) One pair of Resco Marine Corps Foot Measur-

ing Machines is sufficient for all purposes. There is one measurer.

Directly in front of the measuring space is the fitting space equal in area to each of the other two and under cover of canvas. In this is placed the makeshift fitting platform and test incline. Only the common shoe sizes should be procured from the Quartermaster and each size plainly marked by adhesive tape and ink on the side of heel. The shoes may be arranged in parallel rows on benches or logs and replaced as quickly as they are returned. The personnel of the fitting space will consist of one stockman and one fitter.

From this description it can be readily seen that the men will pass through the different spaces in exactly the same manner as in the barrack building.

APPENDIX

OLD ARMY ORDER

COVERING THE SUBJECT OF FOOT-MEASURING AND SHOE-FITTING

General Orders
No. 26.

War Department,
Washington, August 16, 1912.

1. With a veiw to increasing the marching capacity of troops, company commanders will personally measure the feet and fit the shoes of men of their commands and will be held responsible that the instructions herein contained are strictly followed.

All measurements prescribed herein will be taken with the soldier standing in bare feet and with a 40-pound burden on his back, bearing the entire weight upon the foot to be measured. Balance may be preserved by resting the hand on a fixed object. The measurements of the foot, which must be taken to make suitable preliminary selection of the shoe to try on, are (*a*), the length; (*b*) the circumference around the ball.

To measure the length the soldier will stand with foot upon the foot measure, furnished by the Quartermaster's Department, fitted in a slot in a board, the heel of the soldier fitting snugly against the heel block. The movable block will then be pushed up until it touches the end of the great toe. The scale on the top of the measure, which is graduated in sizes, will then be read, and the proper length of the shoe will be determined, approximately, by adding 2 to the reading of

the scale; thus, if the soldier's foot scales 6½, a shoe not smaller than 8½ should be tried on first.

To take the ball measure, pass the foot tape, supplied by the Quartermaster's Department, around the foot at the prominent tubercle at the base of the great toe and the prominent tubercle at the base of the little toe.

The tape should lie closely to the flesh, but should not be so tight as to compress it. Having taken the foregoing measurements, the shoe best suited to the foot will be determined by reference to Circular No. 10, Quartermaster General's Office, April 6, 1912. For example, assume that the circumference of the ball is found to be 9¼ inches. In the table on page 28 of the aforesaid circular, under the heading "Marching shoes," it will be seen that for a foot requiring an 8½ shoe a ball measurement of 9¼ inches corresponds to a D width. The size of shoe to try on for actual fitting is, then, in this case 8½D.

If the ball measurement found as above does not correspond exactly with any ball measurement given in the table, then the narrower of the two widths between which the measurement lies should be selected.

Beginning with the size and width thus tentatively selected, shoes will be tried on until a satisfactory fit is secured. Correct fit in waist and instep will be determined experimentally. To determine the fact of fit the shoe will be laced snugly and the soldier with a 40-pound burden upon his back will again throw his entire weight on one foot. The officer will then press in the leather of the shoe in front of the toes to determine the existence of sufficient vacant space in that region to prevent toe injury. Under no circumstances should this vacant space in front of the great toe to be less than two-thirds inch; nor should there be pressure on the top of the toes.

The officer will then grasp with his hand the leather of the

shoe over the ball. As his fingers and thumb are brought slowly together over the leather, the shoe should feel snugly filled without apparent tension, while the leather should lie smoothly under the hand. If the leather wrinkles under the grasp of the hand, the shoe is too wide and a narrower width is needed; if the leather seems tense and bulging and the hand tends to slip over easily, the shoe is too narrow and a greater width is necessary.

It may be necessary to try on several pairs of shoes in this manner before an entirely satisfactory shoe is secured. A record of the proper size and width of shoes as determined above will be kept as provided in Circular No. 10, Quartermaster General's Office, April 6, 1912.

Measurements will be taken and shoes will be fitted as prescribed at least *once in each enlistment* and the record will be changed from time to time if subsequent fittings render a change necessary.

Sizes called for in requisitions will conform to the record; and the fact of fit of shoes issued on such requisitions will be personally verified in every instance by company commanders in the manner above prescribed.

No shoes will be issued to, or worn by. enlisted men while on duty which are not fitted in accordance with this order.

New shoes should be adapted to the contours of the feet as soon as possible. Shoe stretchers, with adjustable knobs, to take pressure off painful corns and bunions, are issued by the Quartermaster's Department.

All shoes should be properly broken in before beginning a march, but if this is impracticable, then the following is suggested but not required.

The soldier stands in his new shoes in about 2½ inches of water for about five minutes until the leather is thoroughly pliable and moist; he should then walk for about an hour on

level surface, letting the shoes dry on his feet, to the irregularities of which the leather is thus molded in the same way as it was previously molded over the shoe last. On taking the shoes off a very little neat's-foot oil should be rubbed into the leather to prevent its hardening and cracking.

If it is desired to waterproof the shoes at any time, a considerable amount of neat's-foot of should be rubbed into the leather.

Light woolen or heavy woolen socks will habitually be worn for marching; the socks will be large enough to permit of wrinkling. Darned socks, or socks with holes, will not be worn in marching.

Company commanders, by frequent inspections throughout the year, will maintain the feet of their men in condition for proper marching. They will cause the proper trimming of nails, removal or paring of corns and callouses, relief of painful bunions, treatment of ingrowing nails, and other defects, sending serious cases to the surgeon.

Before a march is undertaken by foot troops company commanders will personally inspect the bare feet of their men. While on the march they will personally see each day that their men wash their feet as soon as possible after reaching camp, prick and evacuate blisters, and cover such blisters or excoriations with zinc oxide plaster, supplied by the Medical Department, applied hot, dust the feet with the foot powder supplied by the Medical Department, and put on clean socks. *Hereafter, an undue amount of foot injury and disability from shoes will be regarded as evidence of inefficiency on the part of the officers concerned and as causes for investigation.*

Post quartermasters will provide a place in the quartermaster's storehouse where shoes may be fitted for the purpose of determining or verifying the record required by General Orders, No. 48, War Department, 1911. For the purpose of

fitting they will keep on hand at all times a complete series of each size and width of shoes furnished for issue. Shoes of this series will be put in stock and issued before they become unserviceable, and will be replaced by new shoes, keeping the series always complete. Company commanders will report in writing to the post commander every instance of failure to secure proper shoes for their commands or to obtain proper facilities for fitting the shoes as herein directed. Post commanders will investigate the reasons for and be held responsible as far as lies in their power for the rectification of such deficiencies.

A brief record of the number of such reports from company commanders and the reason for such deficiencies will be furnished to inspectors at each inspection of the post.

Inspections conducted under the provisions of paragraph 913, Army Regulations, will embrace an inquiry into the manner in which this order has been complied with, and the report of inspections will include a statement of all instances of failure on the part of company commanders to secure proper shoes for their commands and the cause of such failure.

(1856626 R—A. G. O.)

11—A new pattern shoe has been adopted for the service which, when the old stock shall have been exhausted, will supersede the different patterns now on hand in the Quartermaster's Department. Hereafter, until the old supply is exhausted, requisitions for shoes will be filled from stock on hand, irrespective of pattern or finish.

(1856626 S—A.G.O.)

By order of the Secretary of War:

LEONARD WOOD,
Major General, Chief of Staff.

Official:
Geo. Andrews,
Adjutant General.

NEW ARMY ORDERS

SPECIAL REGULATIONS NO. 28

TEXT OF REVISED REGULATIONS APPLYING TO THE FIT OF ENLISTED MEN'S SHOES

Changes
No. 3.

War Department,
Washington, September 20, 1918.

Paragraph 14, Special Regulations No. 28, Sanitary Regulations and Control of Communicable Diseases, is changed, as follows:

14. (Changed by S. R. No. 28, C. No. 3, W. D., 1918). Fitting of shoes and care of feet.—With the view of increasing the marching capacity of troops, company, troop, battery and Detachment commanders will personally satisfy themselves that the men of their commands have been properly measured and fitted with shoes and socks, and will be held responsible that the instructions herein contained as to care of feet are strictly followed, and that their men are required to wear shoes and socks properly fitted.

Foot-measuring machines and shoe-fitting devices will be supplied by the Quartermaster Corps in such numbers as may be needed at each camp and garrison post in the United States, the Philippines, Panama Canal and Hawaiian Departments, for use in fitting shoes. The use of the measuring machines and the fitting devices is to be under the supervision of the unit supply officers and supply officers of depot brigades, to whose offices will be attached personnel properly instructed in measuring- and shoe-fitting devices will be kept by company, troop, battery, and detachment commanders.

Directions for operating "Resco" foot-measuring machine:

(*a*) After taking the machine from its box, open it wide by

moving the lever as far front as possible and pulling out the plunger as far as it will go. The machine is now ready for use.

(*b*) Let the man put his foot in the machine and stand with all his weight. The heel should rest firmly against the heel block.

It is important that the foot should rest in the exact center of the machine.

(*c*) Release lever which operates the width indicator, and push the plunger until the plate touches the toe. Do not touch the plunger again while the foot is in the machine. Make sure that the metal side pieces touch the toe joints.

(*d*) Then let the man throw his entire weight on the ball of his foot, raising the heel slightly.

(*e*) The width is automatically registered by the arrow. As the arrow wavers, following the action of the heel up and own, take the average of the extremes. (*Example.* If the arrow wavers from width "*b*" to width "*d*" use width "*c.*") The correct size of the shoe is indicated by the pointer on the plunger on the right-hand scale.

(*f*) Measure the other foot in the same manner and if there should be a difference select size to fit the longer foot and the narrower width.

(*g*) Oil the slide under the device occasionally.

NOTE.—Verify the length selected by testing with shoe-fitting device.

(*a*) Select from the several measuring devices in the set the one marked with the size or half-size corresponding with the shoes to be tried on.

(*b*) Insert the knob end of the device into the toe of the shoe, springing the other end of device down to the inner sole, against the counter.

(*c*) The middle of the flat spring piece will lie flat with slight pressure of the foot.

(*d*) If the soldier, with pack and rifle on his back, can without discomfort pace back and forth in shoes with device inserted, the shoes will be sufficiently long to allow for foot-expansion when device is withdrawn.

NOTE. — The shoes must in every case pass satisfactory the ... above described test.

Shoes of the size indicated by measuring machine, fitted with the proper shoe-fitting device, will be laced snugly; and the soldier with a 40-pound burden on his back will throw his entire weight upon one foot. The officer or enlisted man will grasp with his hand the leather of the shoe over the ball. As his fingers and thumb are brought slowly together over the leather the shoe should feel snugly filled without apparent tension, while the leather should lie smoothly under the hand. If the leather wrinkles under the grasp of the hand the shoe is too wide and a narrower width is needed; if the leather seems tense and bulgy and the hand tends to slip over easily, the shoe is too narrow and a greater width is necessary. Usually it will be necessary to try on several pairs of shoes in this manner before an entirely satisfactory shoe is secured. No shoes will be issued or worn by enlisted men which are not fitted in accordance with this order.

When foot measuring machines and shoe-fitting devices are not available, the procedure in determining the fact of fit of the shoes will be the same as contained in the preceding paragraph. The officer or enlisted man fitting the shoe will also press in the leather of the shoes in front of the toes to determine the existence of sufficient vacant space in that region to prevent toe injury. Under no circumstances should this vacant space in front of the great toe be less than two-thirds of an inch, or the width of a man's thumb, nor should there be pressure on top of the toes.

Measurements will be taken and shoes will be fitted as soon

as practicable after the enlistment or induction of the soldier into the service, and the record will be changed from time to time if subsequent fittings render a change necessary.

Sizes called for in requisitions will conform to the record, and the fact of fit shoes and socks issued on such requisition will be personally verified in every instance by a company, troop, battery, and detachment officer.

New shoes should be adapted to the contours of the feet as soon as possible. Shoe stretchers, with adjustable knobs, to take pressure off painful corns and bunions, are issued by the Quartermaster Corps.

All shoes and socks must be properly broken in before beginning to march. The following is suggested but not required. The soldier stands in his new shoes in about 2½ inches of water for about five minutes until the leather is thoroughly pliable and moist; he should then walk for about an hour on the level surface, letting the shoes dry on his feet, to the irregularities of which the leather is thus molded in the same way as it was previously molded over the shoe last. On taking the shoes off a very little neat's-foot oil should be rubbed into the leather to prevent its hardening and cracking.

If it is desired to waterproof the shoes at any time, a considerable amount of dubbin should be rubbed into the leather.

Shoes issued to enlisted men will be regularly inspected by company, troop, battery, and detachment commanders to see that water-proofing substance is applied often, and that they are not injured by being placed too near heating apparatus. Heat ruins leather and causes wet leather to decompose rapidly.

Light woolen or heavy woolen socks will habitually be worn for marching; the socks will be large enough to permit free movement of the toes, but not so loose as to permit of wrinkling. Darned socks or socks with holes, will not be worn in

marching. (This is not to be construed, however, as prohibiting soldiers from wearing properly darned socks while on ordinary duty, at drill, etc. If on marches two pairs of socks are worn, the outer pair may be darned socks.) Woolen socks will shrink about one size after being washed a few times. Proper fitting of socks must be secured under personal supervision of a company, troop or battery officer.

Company, troop, battery, and detachment commanders, by frequent inspections and care throughout the year, will maintain the feet of their men in condition for proper marching. They will cause the proper trimming of nails, removal or paring of corns and callouses, relief of painful bunions, treatment of ingrowing nails, and other defects, sending serious cases to the surgeon.

Before a march is undertaken by foot troops, company, troop battery, and detachment commanders will personally inspect the feet of their men in condition for proper marching. They will cause the proper trimming of nails, removal or paring of corns and callouses, relief of painful bunions, treatment of ingrowing nails, and other defects, sending serious cases to the surgeon.

Before a march is undertaken by foot troops, company, troop, battery, and detachment commanders will personally inspect the bare feet of their men. While on the march they will personally see each day that their men wash their feet as soon as possible after reaching camp, prick and evacuate blisters, and cover such blisters or excoriations with zinc oxide plaster supplied by the medical department, applied hot, dust the feet with a foot powder supplied by the medical department, and put on clean sock. Hereafter, an undue amount of foot injury and disability from shoes will be regarded as evidence of inefficiency on the part of the officers concerned and as causes for investigation.

A place will be provided where officers may have shoes fitted for the purpose of determining or verifying the record. For the purpose of fitting unit supply officer they will draw from the camp quartermaster, on memorandum receipt, a try-on set consisting of a complete series of each size and width of shoes furnished for issue. Shoes of this series will be put in stock and issued before they become unserviceable, and will be replaced by new shoes, keeping the series always complete. Company, troop, battery, and detachment commanders will report in writing to the post or regimental commander every instance of failure to secure proper shoes for their command. Post or regimental commanders will investigate the reasons for and be held responsible as far as lies in their power for the rectification of such deficiencies.

A brief record of the number of such reports from company, troop, battery and detachment commanders, and the reason for such deficiencies will be furnished to inspectors at each inspection of the post.

Inspections conducted under the provisions of paragraph 889, Army Regulations, will embrace an inquiry into the manner in which this order has been compiled with, and the report of inspections will include a statement of all instances of failure on the part of company, troop, battery, and detachment commanders, to secure proper shoes for their commands and the cause of such failure. (S. R. No. 28, C. No. 3, Sept. 20, 1918.)

By Order of the Secretary of War:

PEYTON C. MARCH,
General, Chief of Staff.

Official:
P. C. Harris,
Acting Adjutant General.

MARINE CORPS ORDERS

(*a*) Marine Corps Orders No. 38 (Series 1915.) October 12, 1915, Par. 185.

(*b*) Marine Corps Orders No. 42 (Series 1915), December 20, 1915, Paragraphs 185 and 190.

(*c*) Marine Corps Orders No. 37 (Series 1916), November 4, 1916, Par. 258.

Marine Corps orders No. 38 (Series 1915), October 12, 1915, Par. 185, amended to read as follows:

"185. (1) Instructions for fitting of shoes. The man to be fitted should sit on a chair in a natural position with one leg crossed over the other, as shown in the illustration below.

"2. It is recognized that in most cases a man's feet are not exactly the same size, one being a little larger than the other; therefore, in measuring for shoes, the length of each foot will be measured with the standard size stick, furnished by the Quartermaster's Department. To determine the approximate size of shoe for the man to be fitted, two sizes will be added to the largest measurement shown on the stick; thus: If a man's larger foot measures five (5) on the size stick, add two (2) sizes to same, which will call for a number seven (7) shoe; if the foot measures six and one-half (6½), add two (2) sizes to same, which will call for a number eight and one-half (8½) shoe, and so forth. Beginning with the size thus selected, shoes will be tried on until a satisfactory fit is secured."

Marine Corps Orders
Number 42 (Series 1915).

Headquarters,
U. S. Marine Corps,
Washington, December 20, 1915.

190. (1) The individual cards for recording sizes of shoes are hereby dispensed with

(2) Paragraphs 185 (4) and 185 (5), Marine Corps Orders are revoked and the following substituted:

185. (4) After determining the correct length and width of shoe to fit a man's larger foot, entry of such size will be made in the man's service-record book and thereafter no other size shoe will be issued to him, unless it is proven by a refitting that a different size is required, in which case his records will be changed accordingly.

(5) Upon receipt of this order all men will be measured in order to ascertain the correct size of shoe they should wear and the necessary notations in their service-record books will be made. (M.C.O. 42, 12-20-15.)

GEORGE BARNETT,
Major General Commandant.

Office of the Post Commander,
Marine Barracks, Quantico, Va.,
January 28, 1919.

Post Special Order No. 47.

1. Building No. 503 has recently been fitted up and is now available for the purpose of obtaining proper foot measurements for all men of this command. Lieutenant S. A. Folsom, M. C. USN., at Dispensary No. 6, telephone No. 231 is in charge of this work.

2. It is the intention eventually to have every man of each organization at this post scientifically measured so as to insure a perfect fitting shoe, and in order to accomplish this with as little delay and disorganization of the routine as possible, the following procedure will govern:

(*a*) Whenever men of any organization desire shoes, the commanding officer of such organization will communicate with Lieutenant Folsom to ascertain the time that such measurements can be made.

(*b*) These men will be required to wash their feet and put on clean socks, and, accompanied by their service record books, will then be marched in heavy marching order with rifles to building 503 and measured in the presence of a commissioned officer of the organization concerned, who will assist in making such measurements under the direction of the medical officer in charge, and will as soon as same have been completed make a permanent record in the service record books of the men concerned.

(*c*) Thereafter, shoes of the recorded size only will be issued, and in submitting clothing requisitions on which shoes appear, great care must be exercised by the officers preparing the requisitions and issuing the clothing, to see that this is strictly complied with.

(*d*) In case a man complains that shoes issued in accordance, with such measurements do not fit properly and are not comfortable, a remeasurement will be taken by the officer in charge of the foot-measuring squad in building 503.

By Order of Brigadier General Myers.

S. M. HARRINGTON,
Major, Ass't A. & I., M. C.,
Post Adjutant.